Onsite Wastewater Treatment Technologies

Bruce J. Lesikar

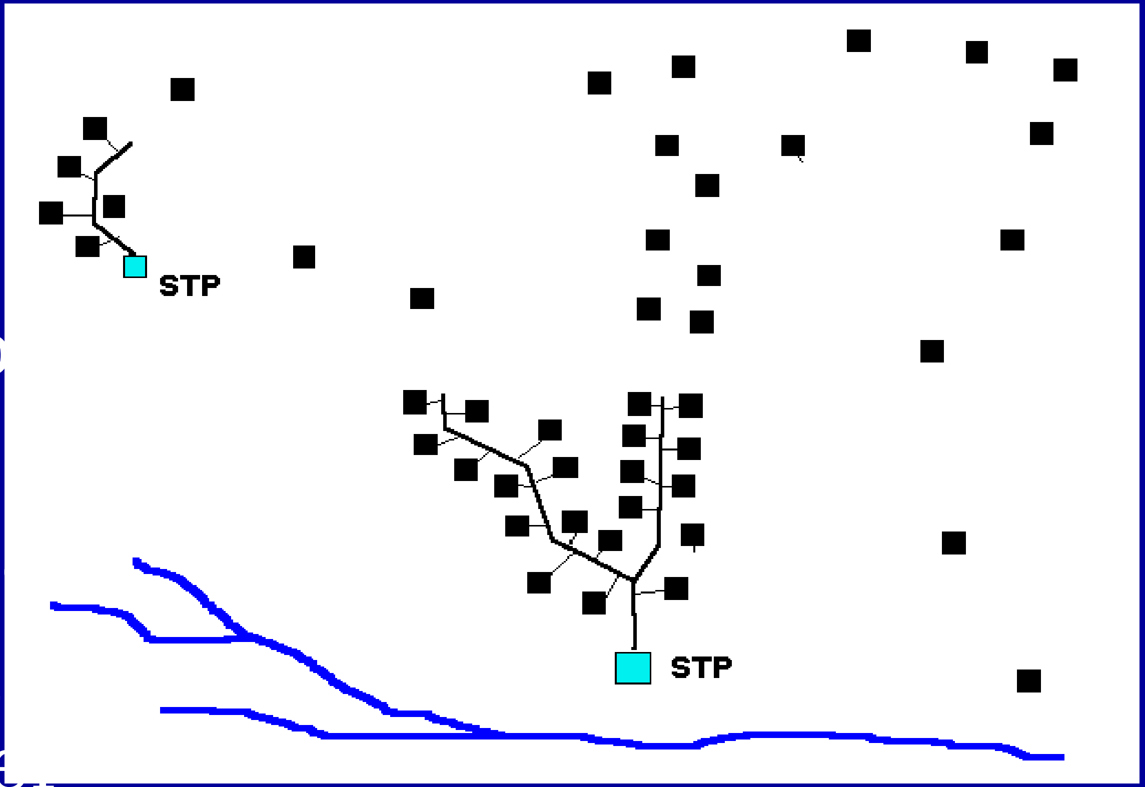
Associate Professor

Texas Cooperative Extension

Texas A&M University System

Decentralized Wastewater Treatment

- Appropriate cost effective systems.
  - Onsite
  - Cluster
  - Centralized
- Public perceptio
- Failed systems
- New Technologi
- Different from a centralized sewe



Onsite Wastewater Treatment Systems?

- Rural and Exurban wastewater infrastructure

-Water Quality Protection

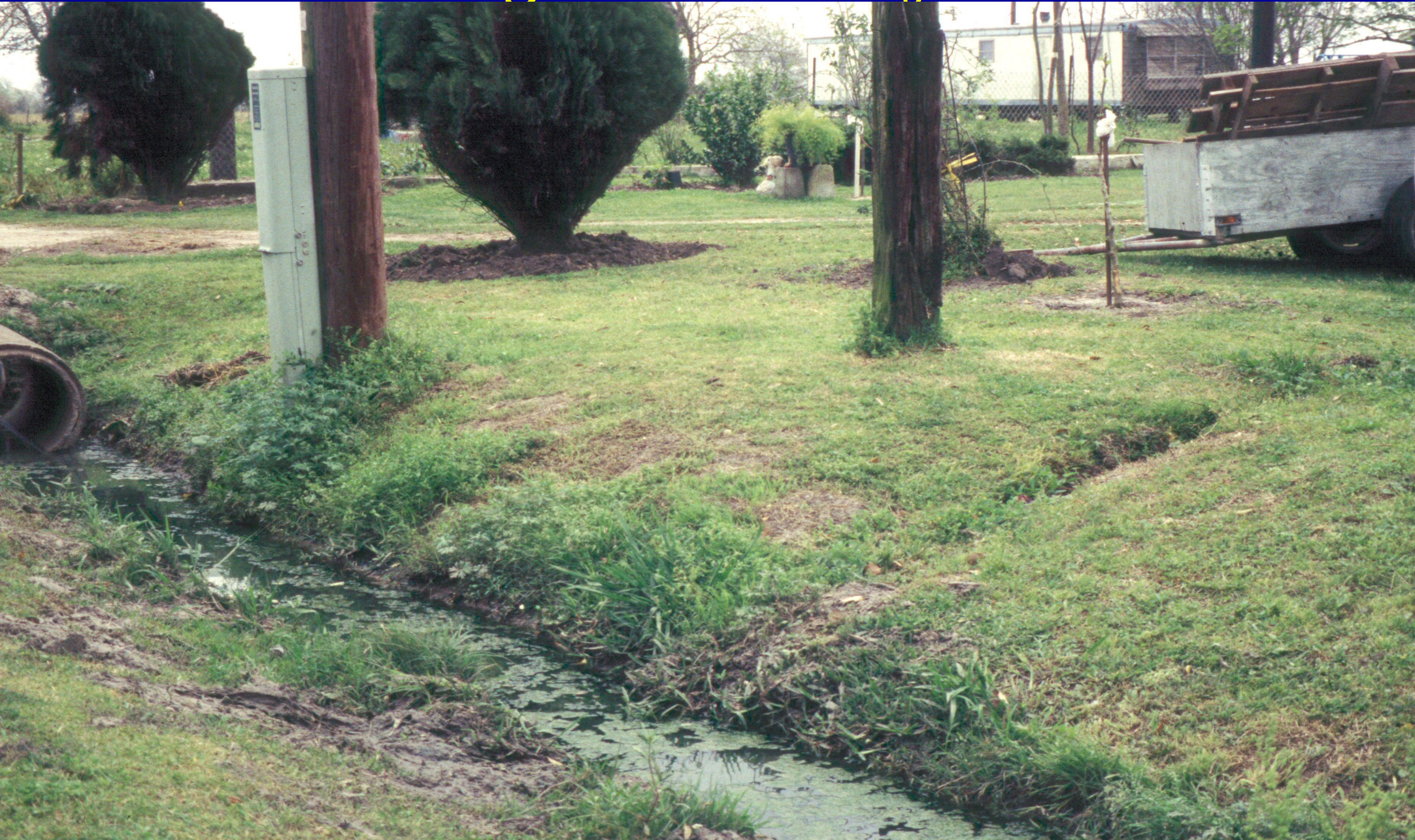
- 40%, Wastewater Infrastructure

Permitting Dispersal Systems

- TCEQ, Chapter 285, 5000 gallons per day or less
- TCEQ, Chapter 317, Greater than 5000 gallons per day.
- Additional requirements for 317 Permits
  - Potential groundwater impact due to water quality and mounding potential
  - Detailed soil analysis
  - Location of water wells within ½ mile
  - Uniformity of effluent distribution

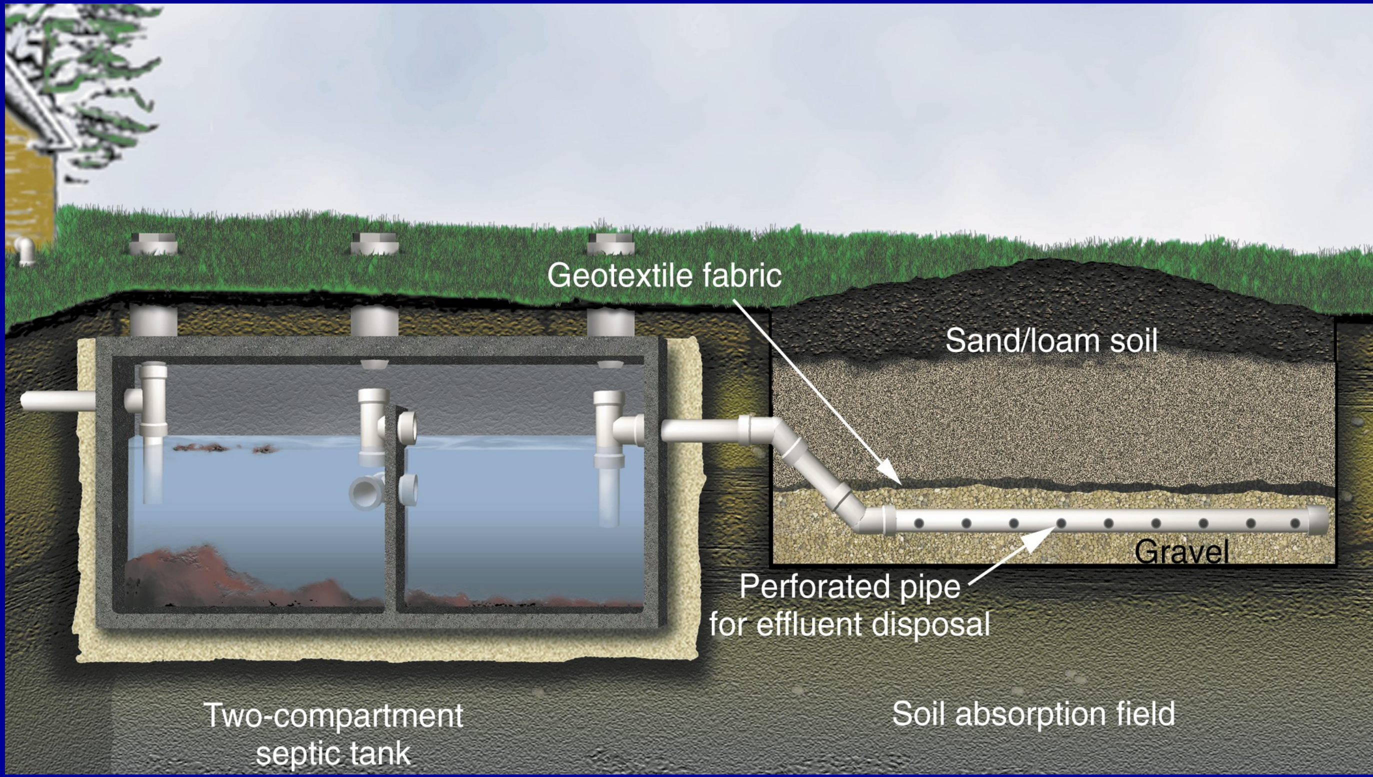
Onsite Wastewater Treatment System

Failing Onsite System



On-Site Wastewater Treatment System Components

- Wastewater source
- Collection
- Pretreatment component
- Final treatment & dispersal component


Geotextile fabric
Sand/loam soil
Gravel
Perforated pipe for effluent disposal
Two-compartment septic tank
Soil absorption field

How do we make the system work?

- Evaluate the wastewater source
- Evaluate site
  - Wastewater treatment
  - Wastewater acceptance
- Choose a final treatment and dispersal component
- Choose the appropriate pretreatment system
- Operation and Maintenance

Types of Facilities – Wastewater Sources

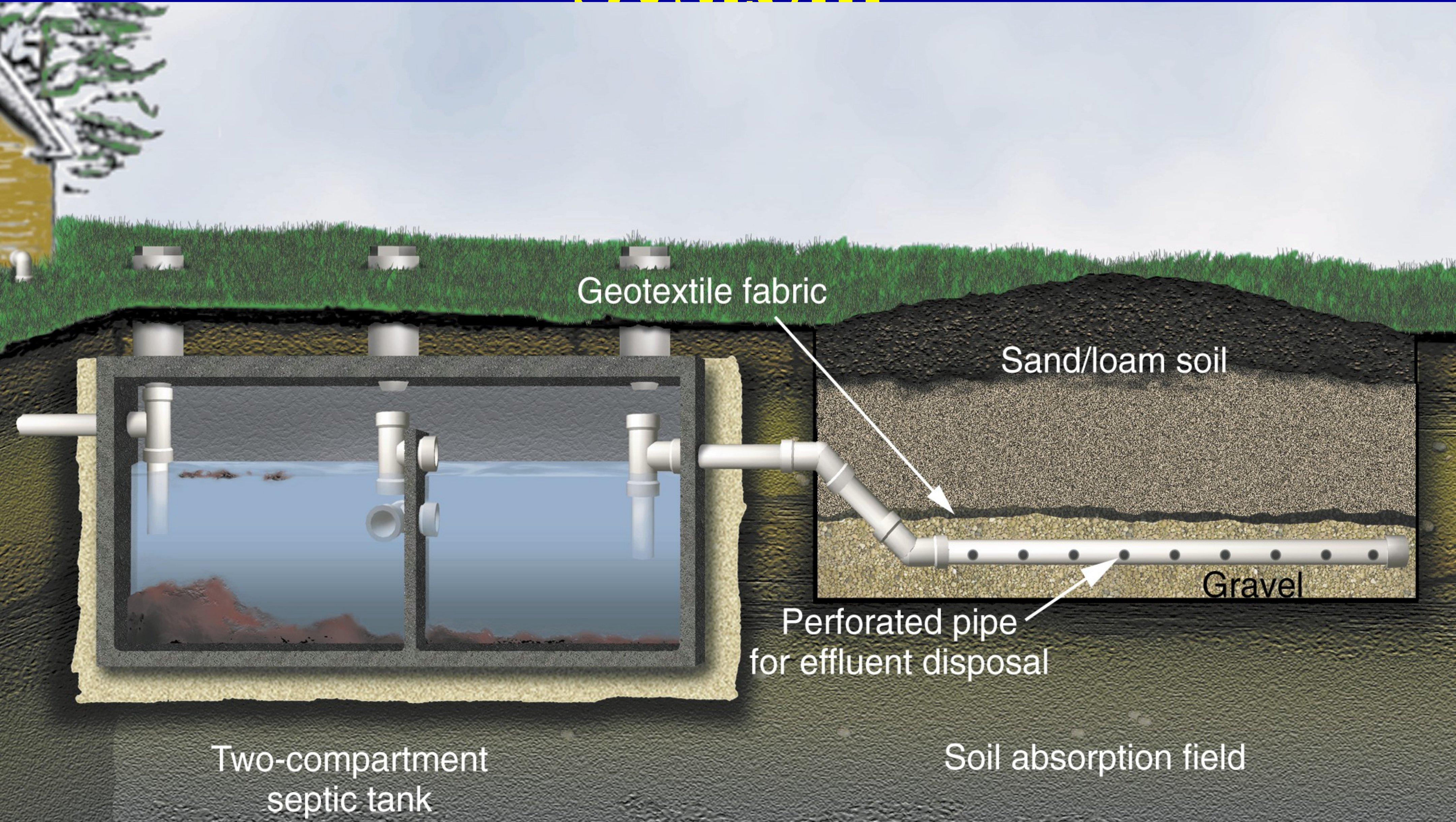
- Restaurants
- Quick Stops
- Strip Malls
- Residences

DIESEL
1.32
DORAL

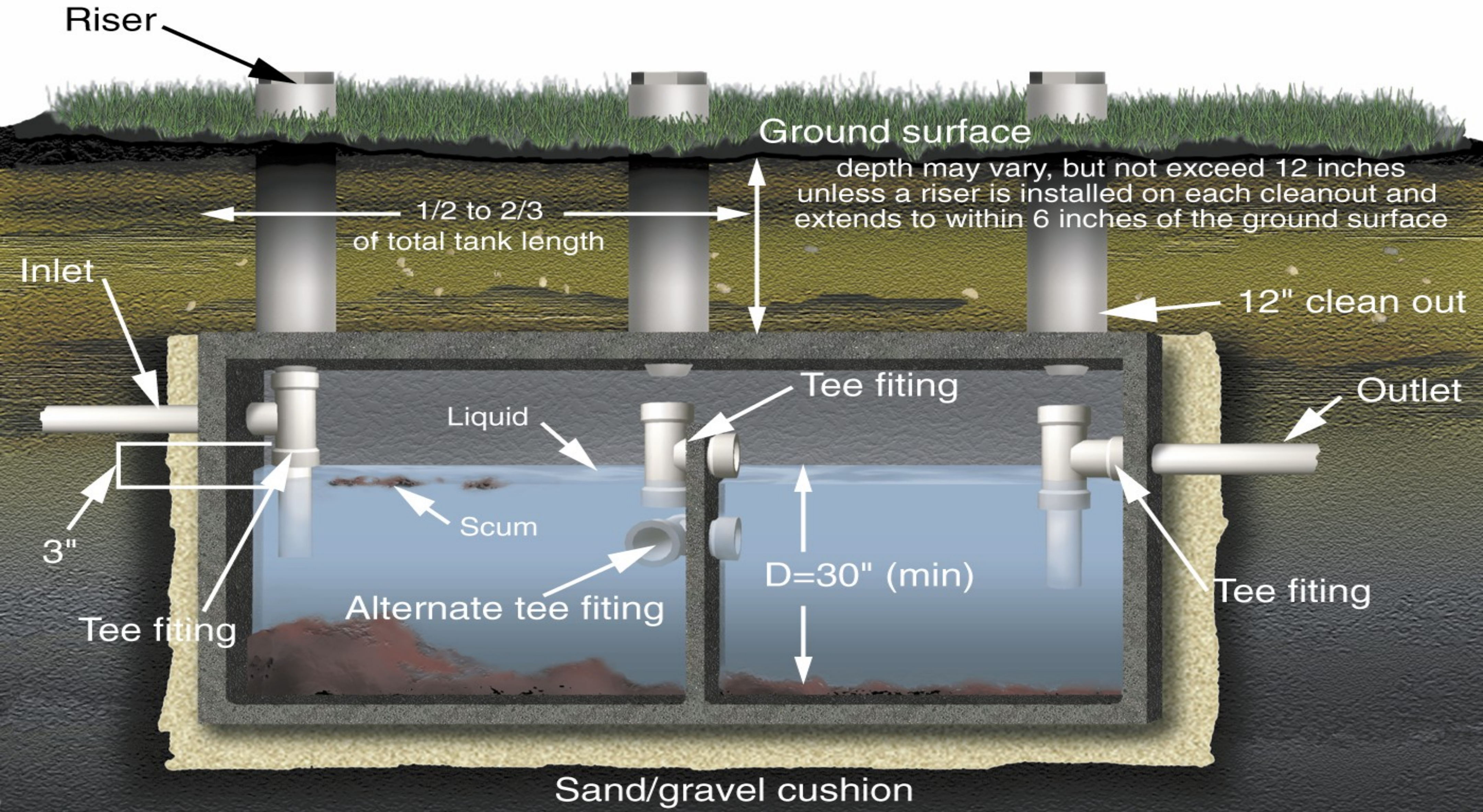
Wastewater Treatment at a Site

- Soil
    - Type
    - Depth
- Slope
- Restrictive layers
- Separation distances

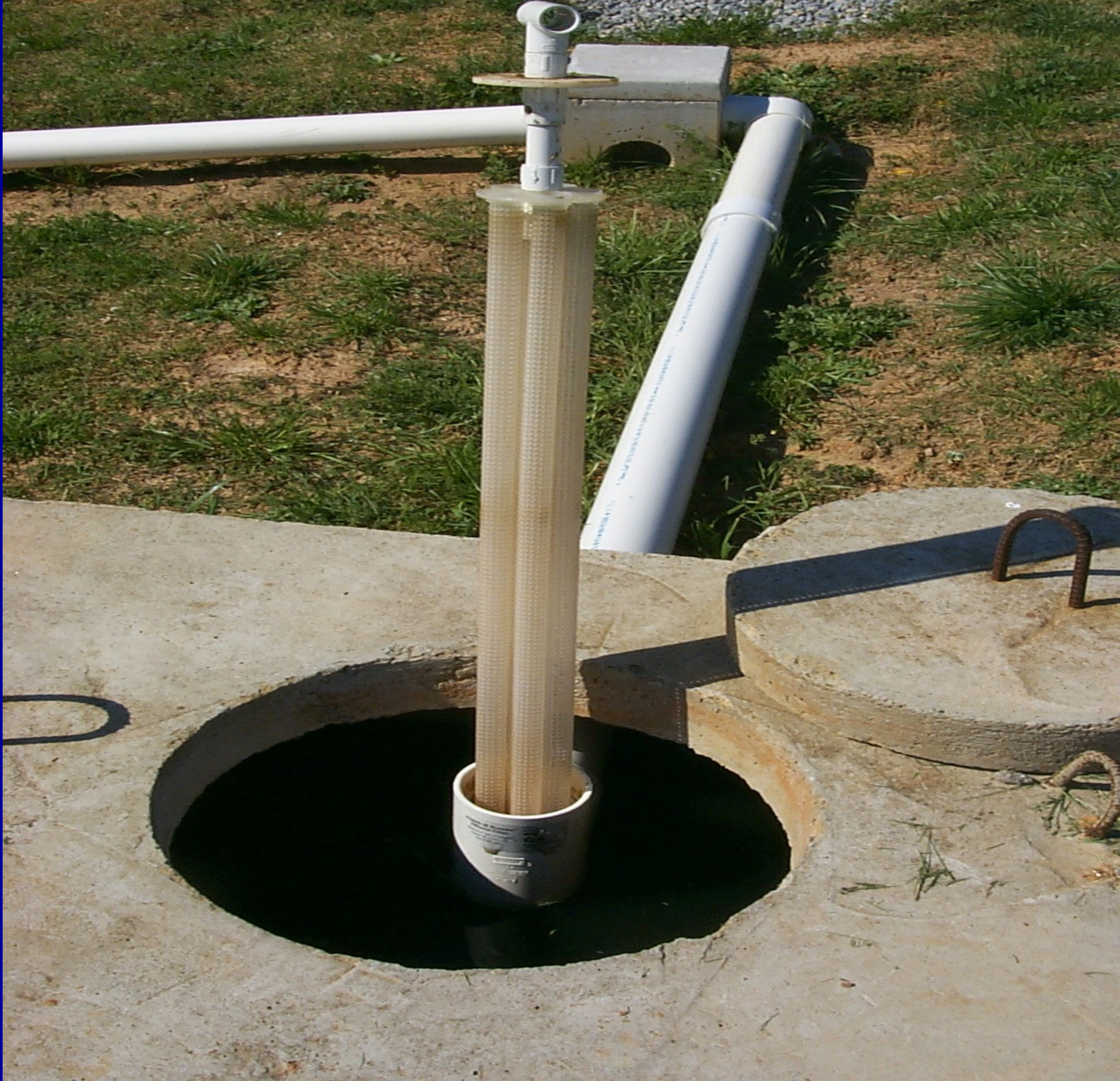
Conventional Septic Tank System

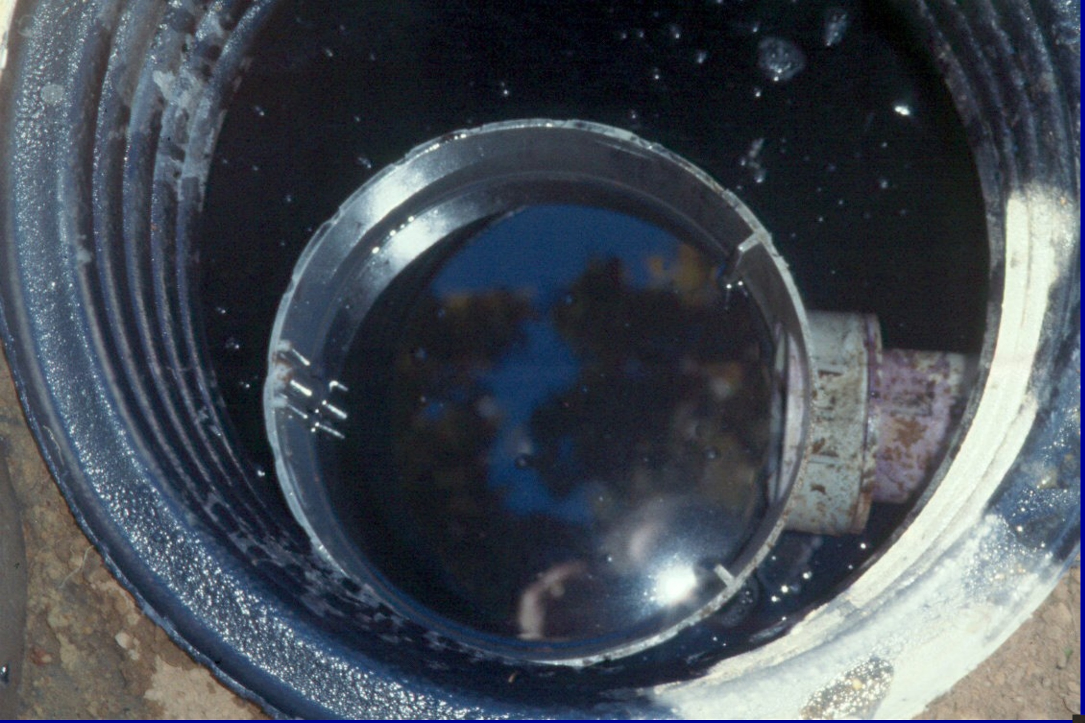

Geotextile fabric
Sand/loam soil
Gravel
Perforated pipe for effluent disposal
Two-compartment septic tank
Soil absorption field

Two-Compartment Septic Tank


Riser
Ground surface
depth may vary, but not exceed 12 inches unless a riser is installed on each cleanout and extends to within 6 inches of the ground surface
1/2 to 2/3 of total tank length
Inlet
12" clean out
Tee fiting
Outlet
Liquid
Scum
3"
Alternate tee fiting
D=30" (min)
Tee fiting
Tee fiting
Sand/gravel cushion

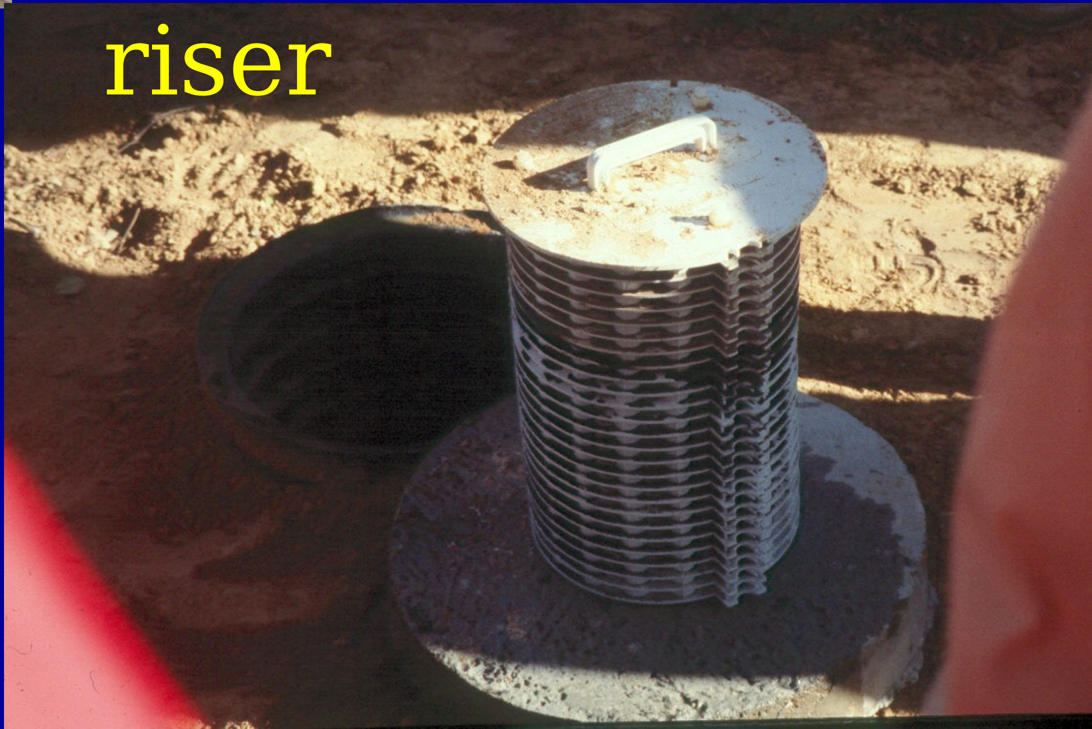
Effluent Filter in Septic Tank Outlet





Effluent filter holder in septic tank outlet

Placement off-center in the riser



Effluent filter with biological material attached to the surface

Wash biological

B & B
SEPTIC SYSTEMS - PUMPING SERVICE
378-6415 372-8714
"THE BEST IN THE BUSINESS, BECAUSE WE WANT TO BE"
B & B
SEPTIC SYSTEMS
TDH 20338
CITY C-007

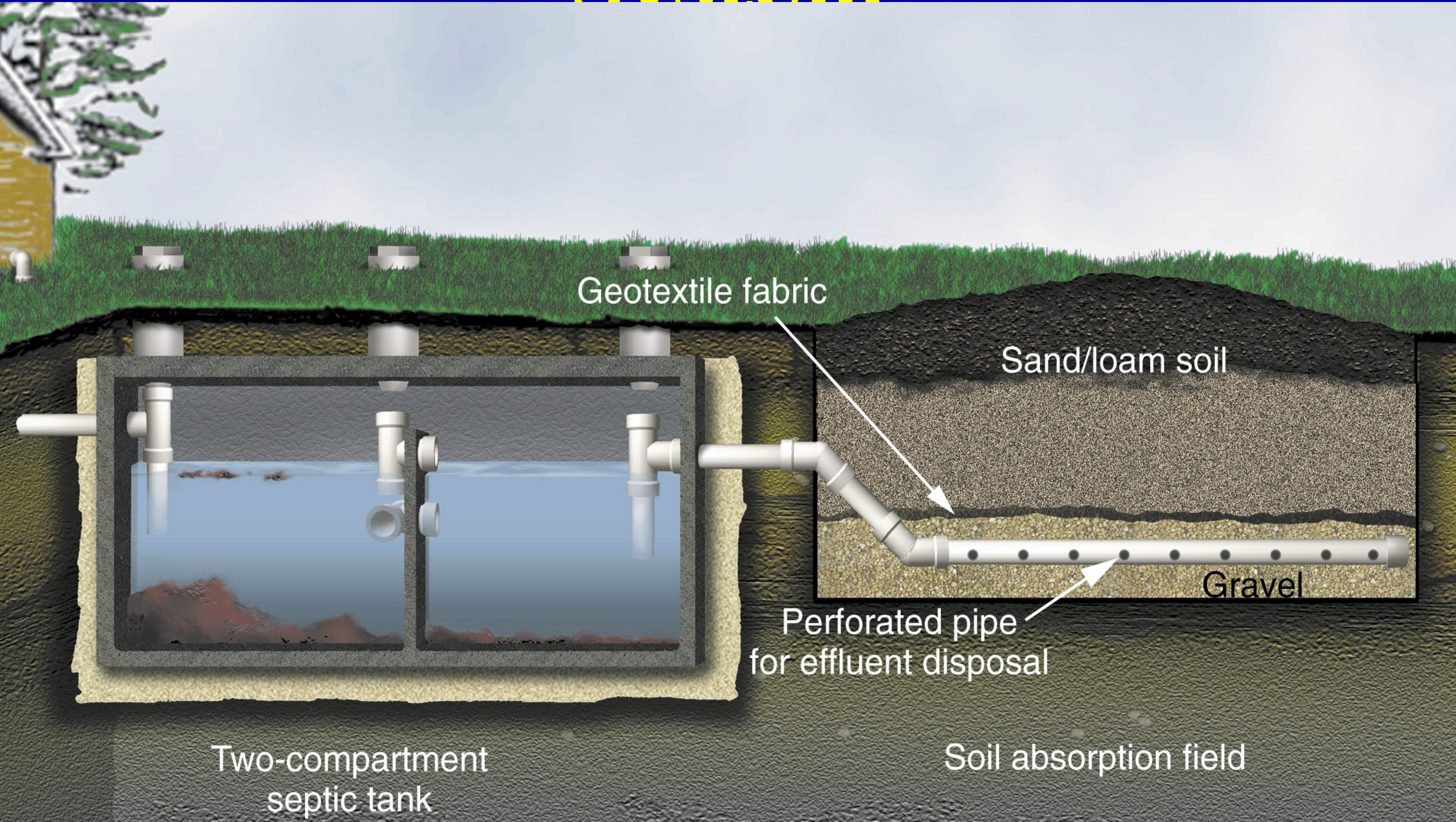
Septic tank pumping is a critical component of operation and maintenance.

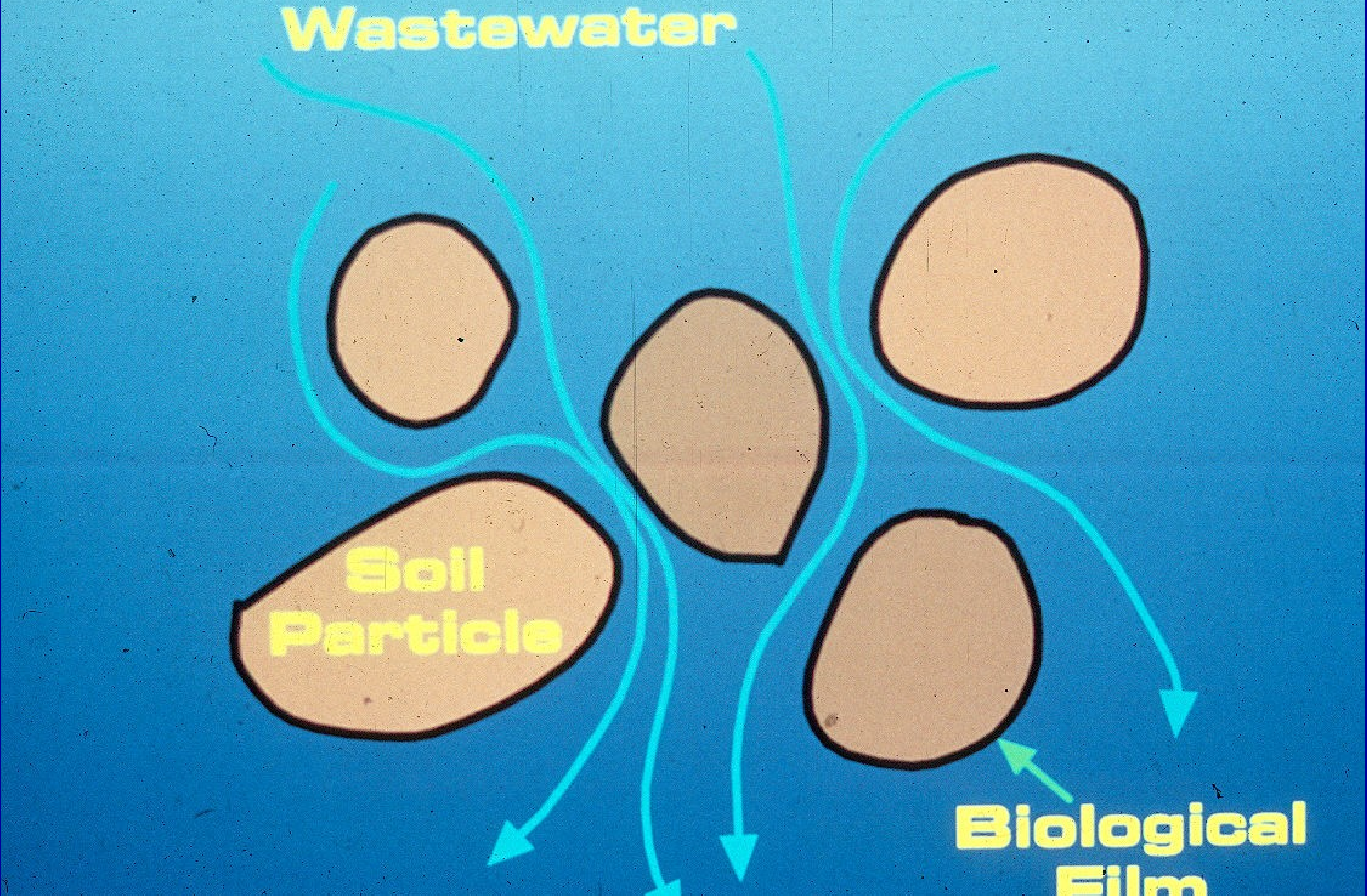
All materials are removed during pumping.

Pumping frequency is a function of system size and loading

Generally pumping frequency is every two to three years.

Conventional Septic Tank System


Geotextile fabric
Sand/loam soil
Gravel
Perforated pipe for effluent disposal
Two-compartment septic tank
Soil absorption field

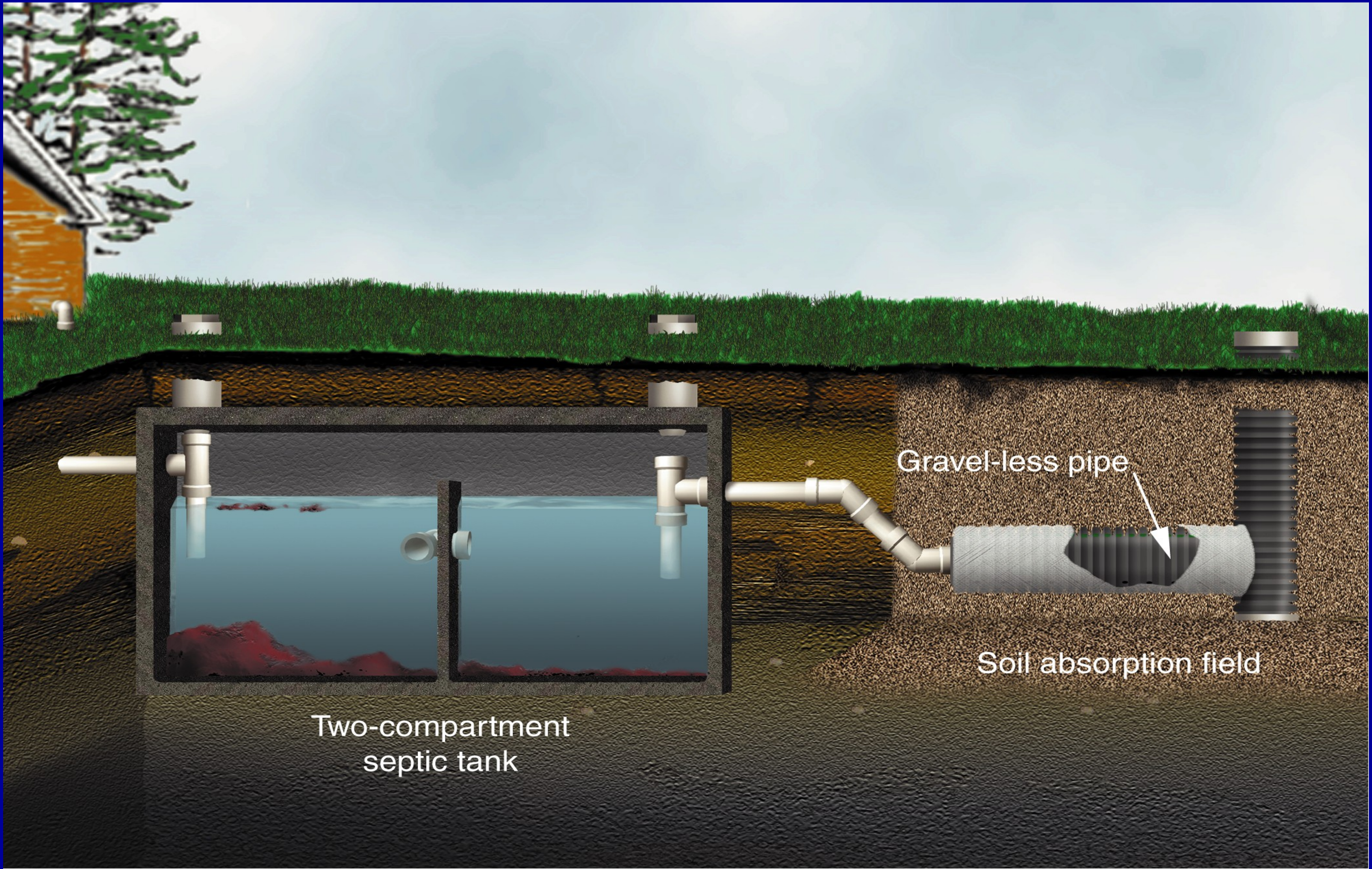


Wastewater

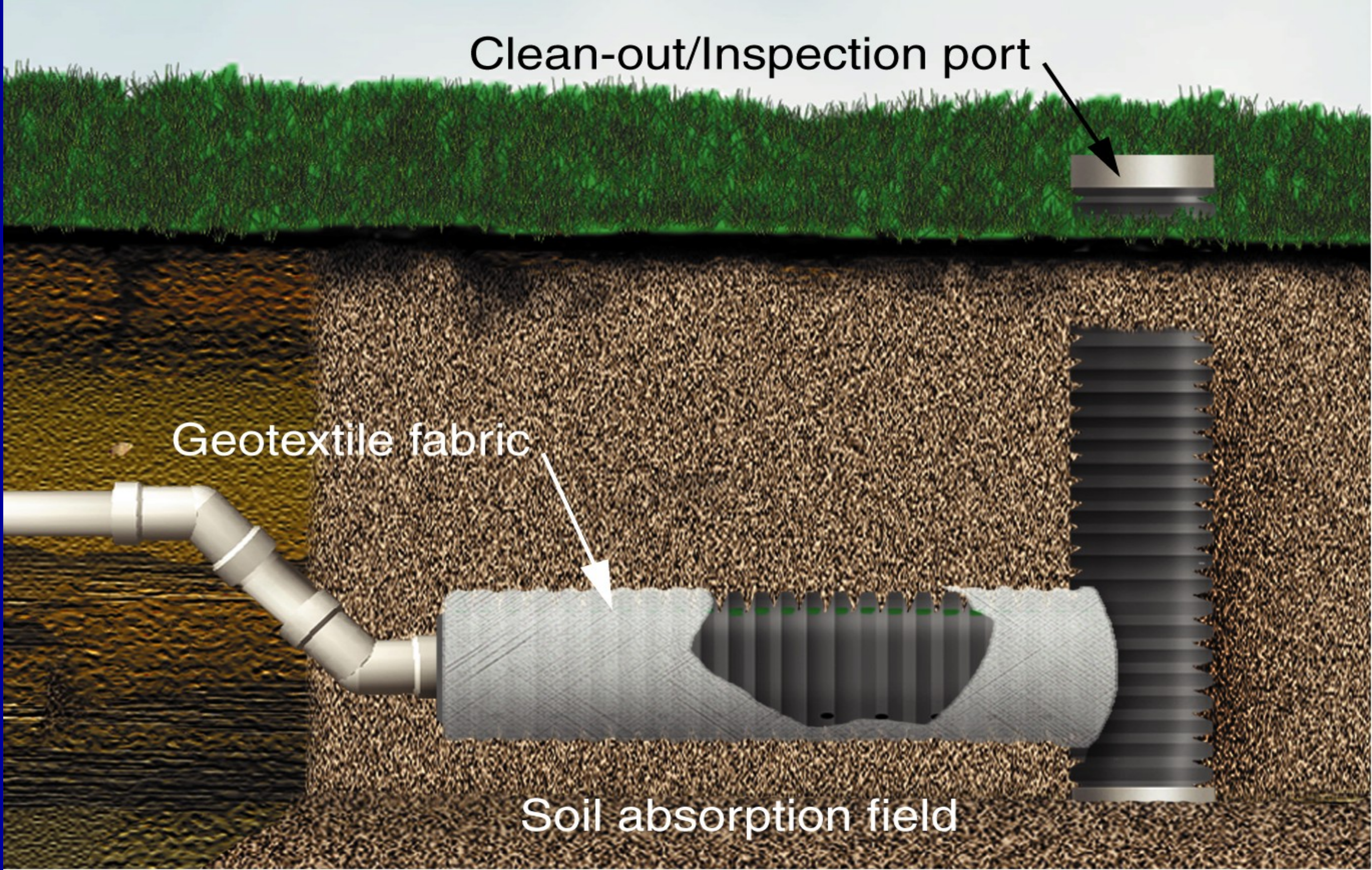
Soil Particle

Biological Film

Gravel-less Pipe System

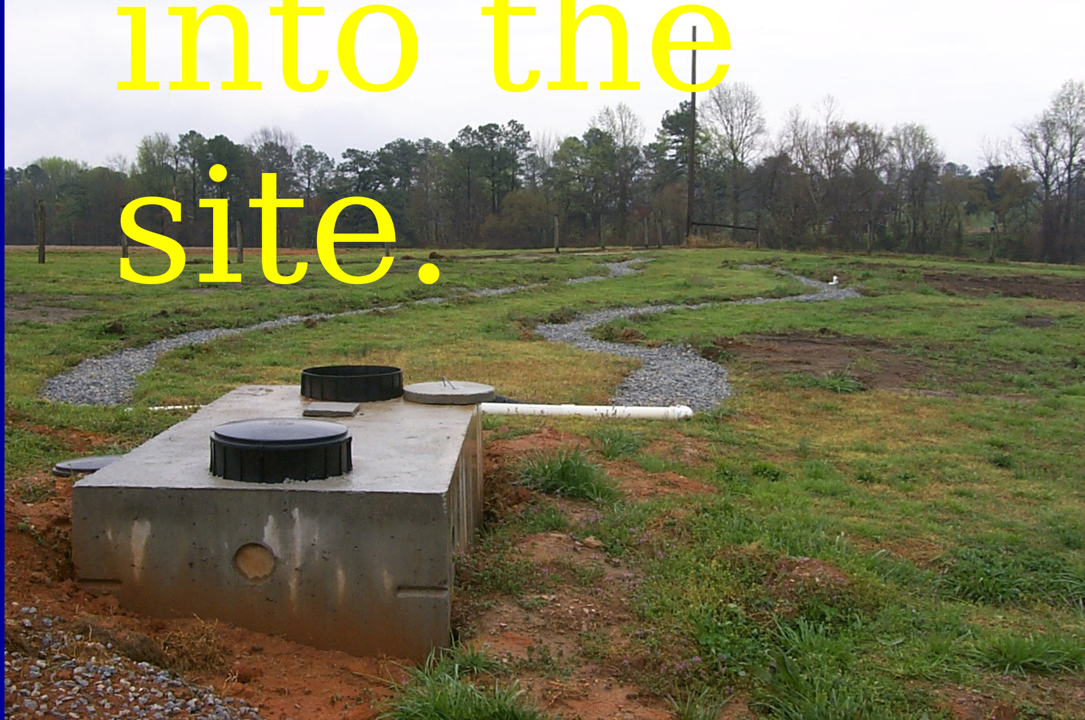

Gravel-less pipe
Soil absorption field
Two-compartment
septic tank

Gravel-less Pipe Drain Field

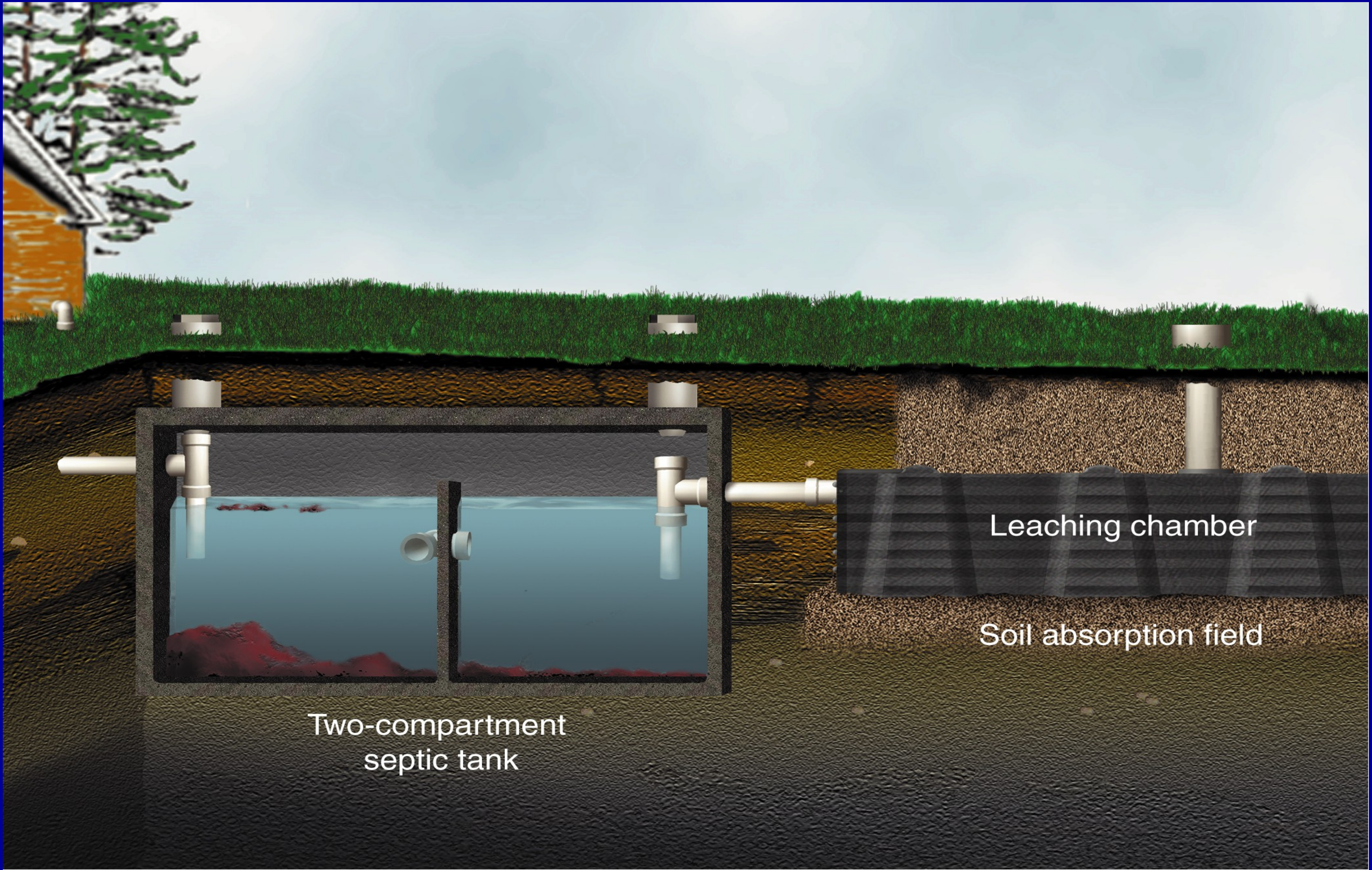

Clean-out/Inspection port
Geotextile fabric
Soil absorption field

Light-weight for carrying into the site.

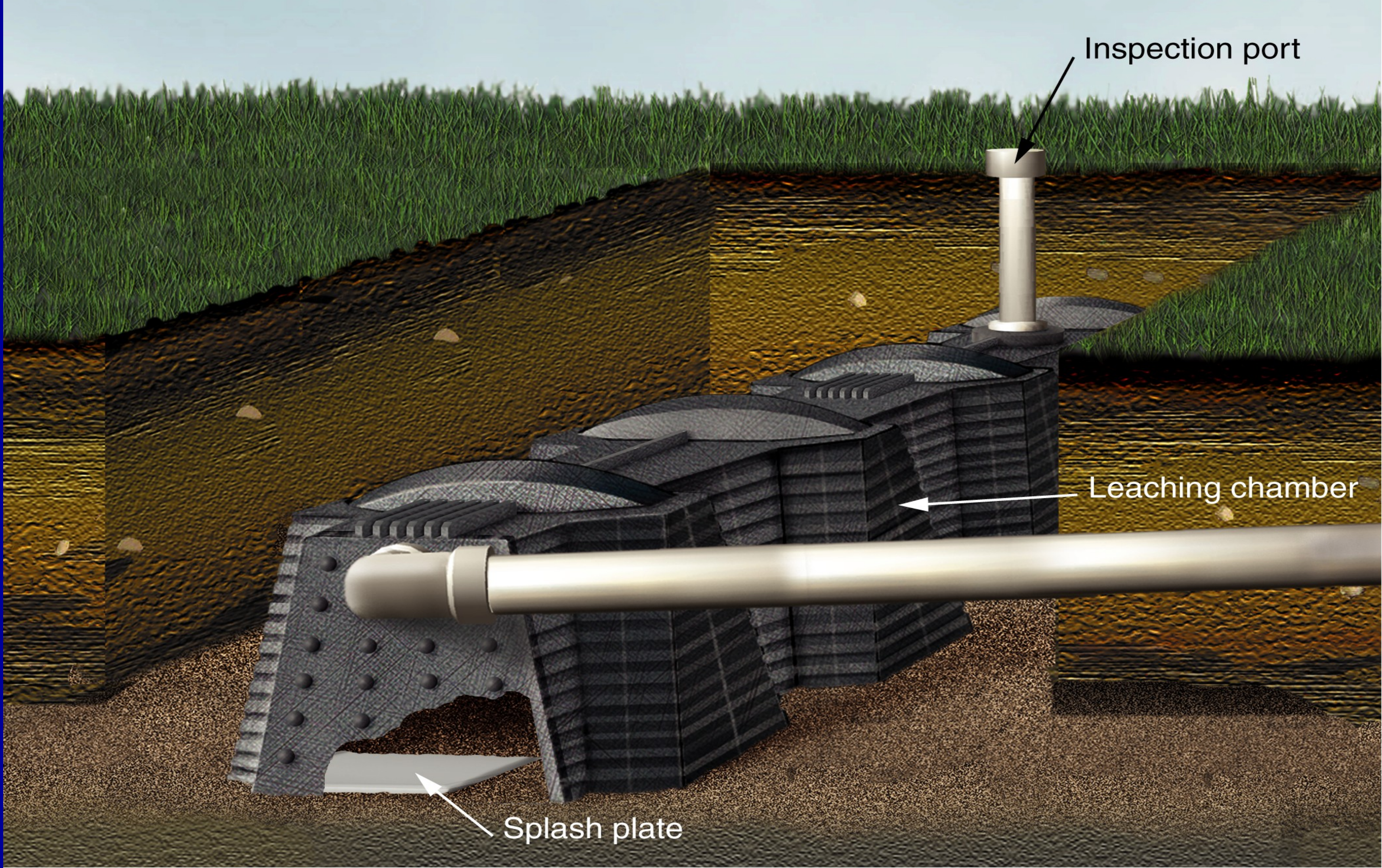
System can be installed to follow contour of the site.



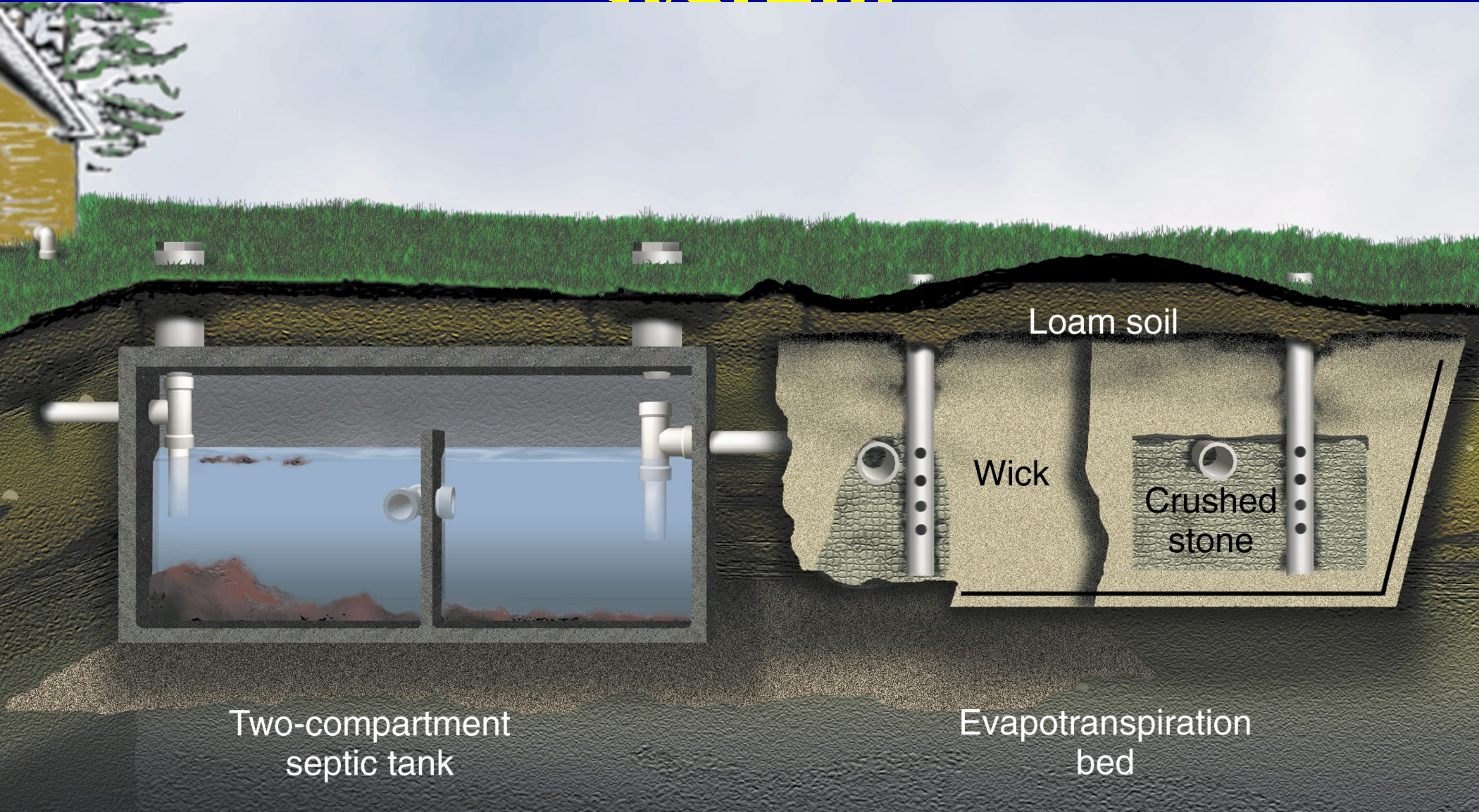
Chamber System


Leaching chamber
Soil absorption field
Two-compartment septic tank

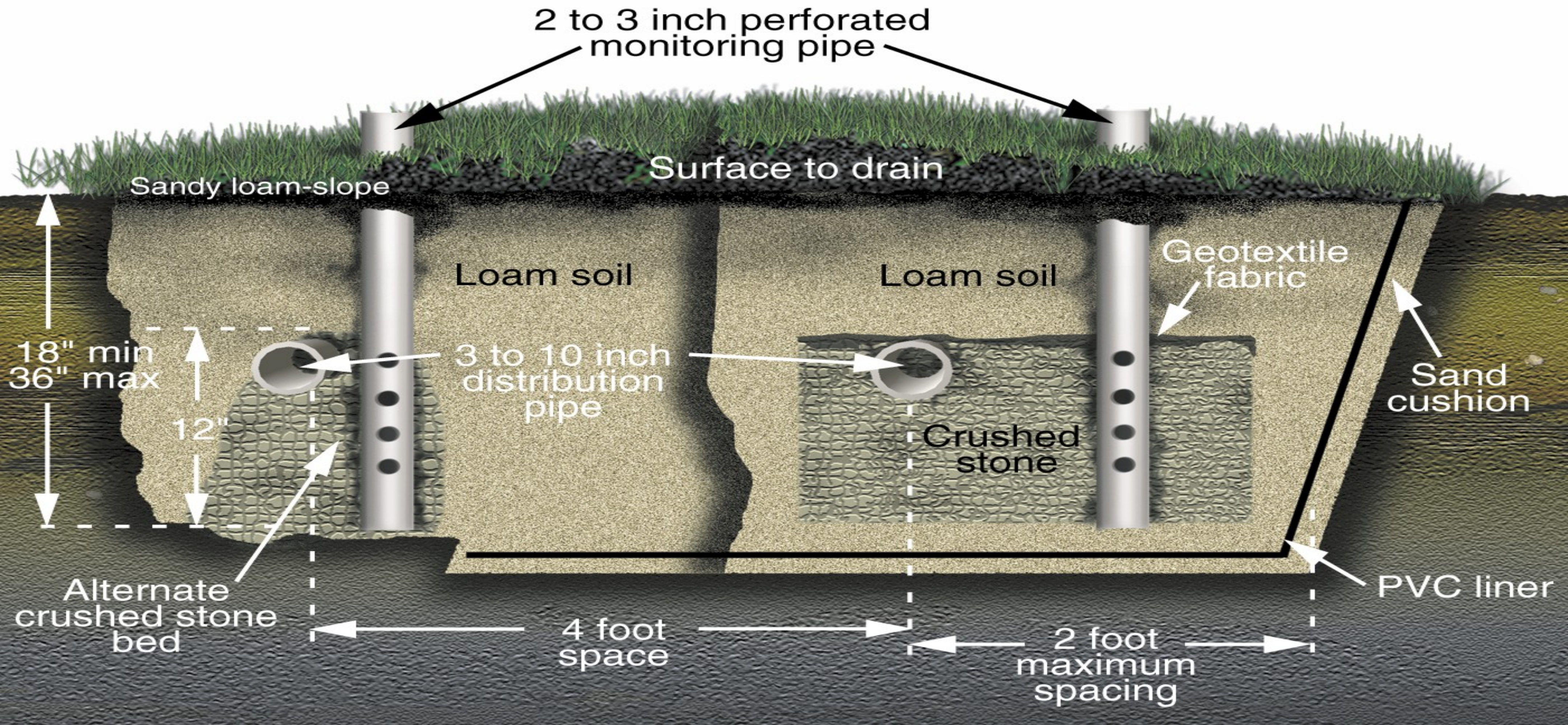
Chamber Drain Field

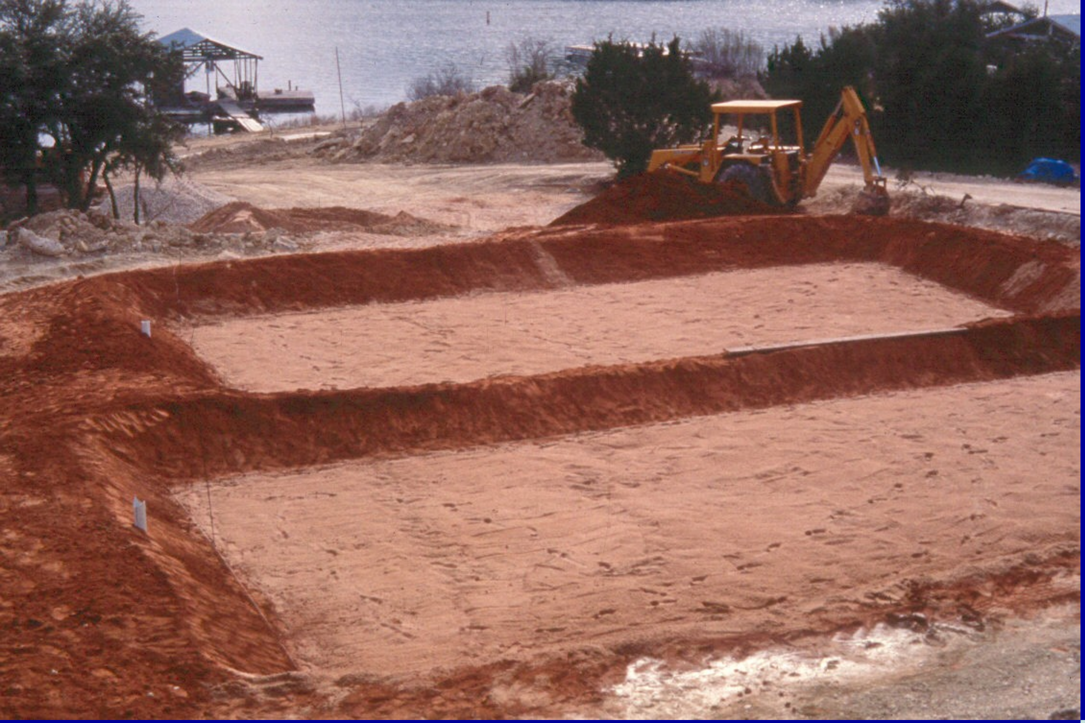

Inspection port
Leaching chamber
Splash plate

Evapotranspiration Bed System


Loam soil
Wick
Crushed stone
Two-compartment septic tank
Evapotranspiration bed

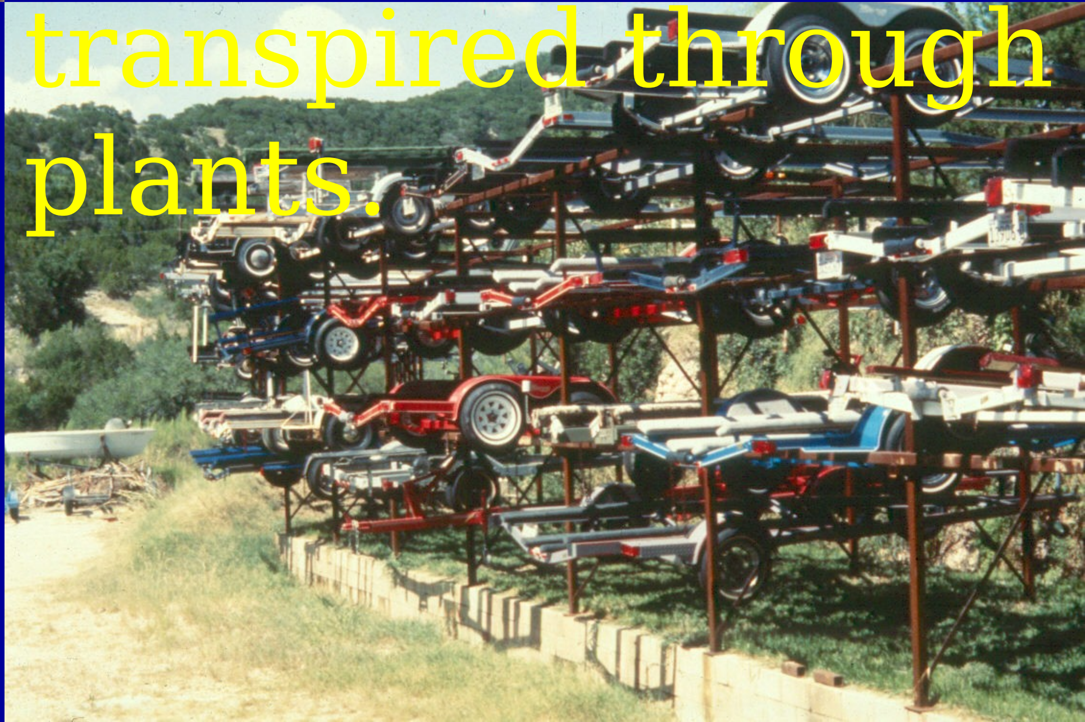
Evapotranspiration Bed


2 to 3 inch perforated monitoring pipe
Surface to drain
Sandy loam-slope
Loam soil
Loam soil
Geotextile fabric
18" min 36" max
12"
3 to 10 inch distribution pipe
Crushed stone
Sand cushion
PVC liner
Alternate crushed stone bed
4 foot space
2 foot maximum spacing

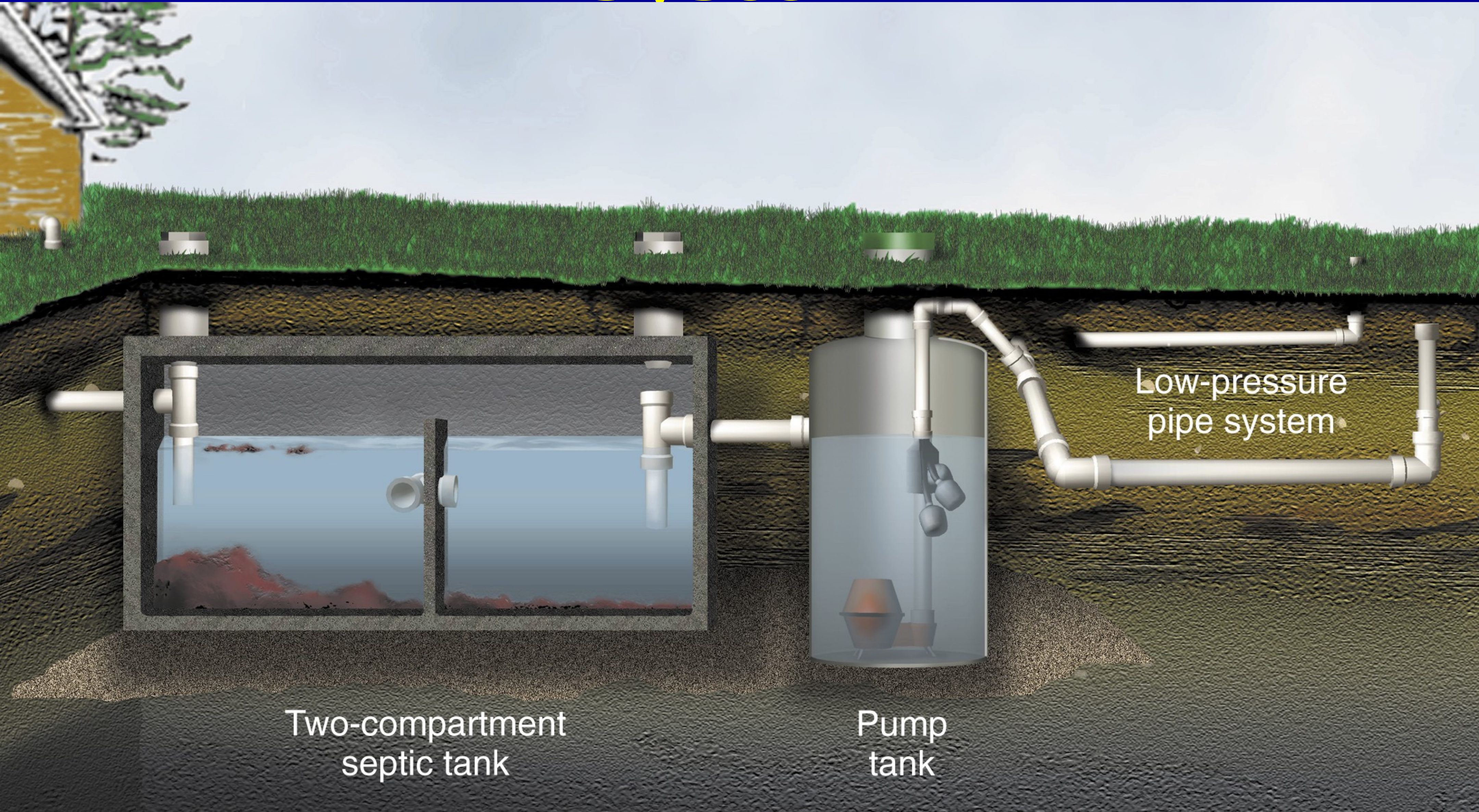


Evapotranspiration beds for storing water until evaporated from soil surface or transpired through plants.

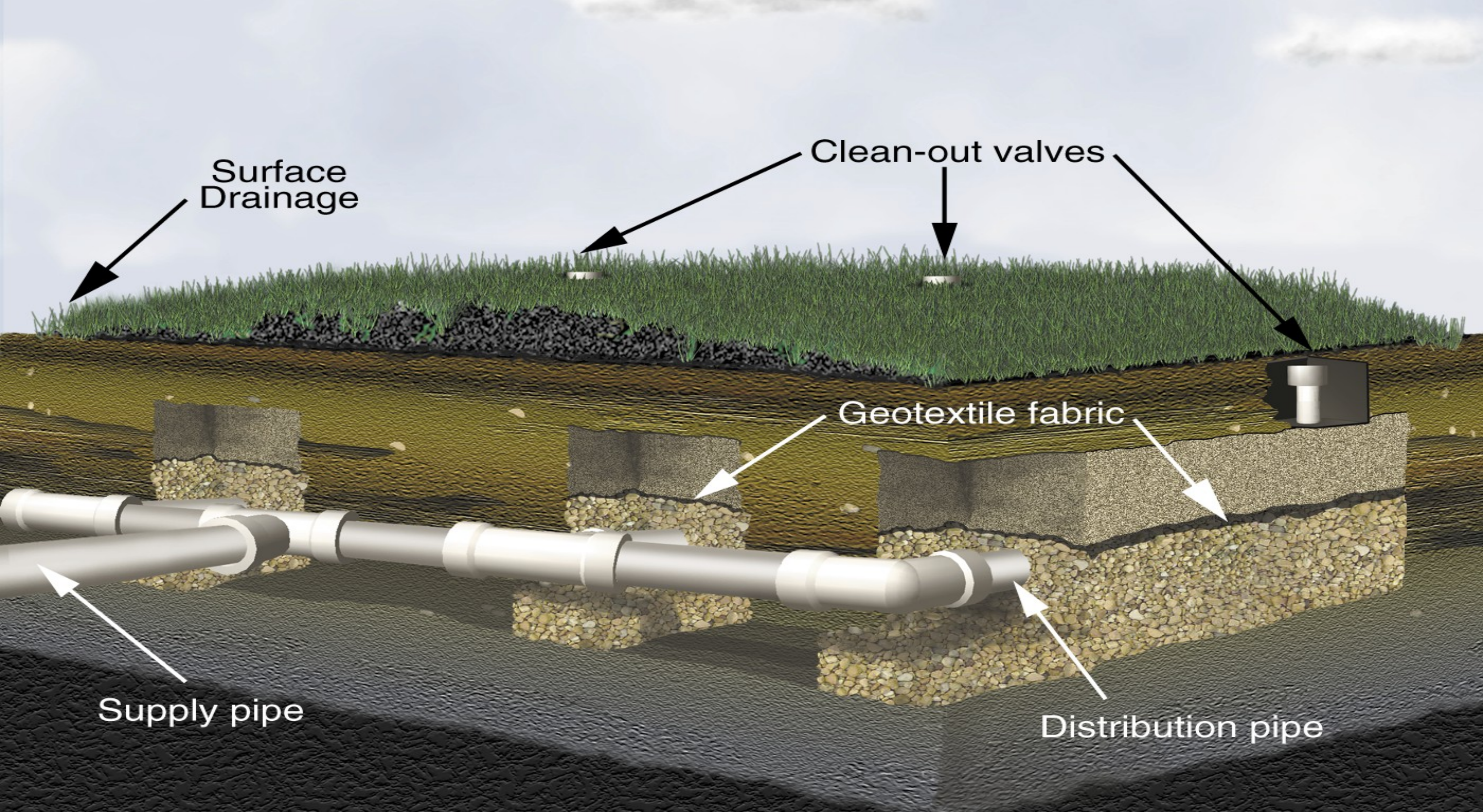
Lined bed below trailers. Grass must be maintained to



Low-Pressure Distribution System


Low-pressure pipe system
Two-compartment septic tank
Pump tank

Low-Pressure Distribution Drain Field


Surface Drainage
Clean-out valves
Geotextile fabric
Supply pipe
Distribution pipe

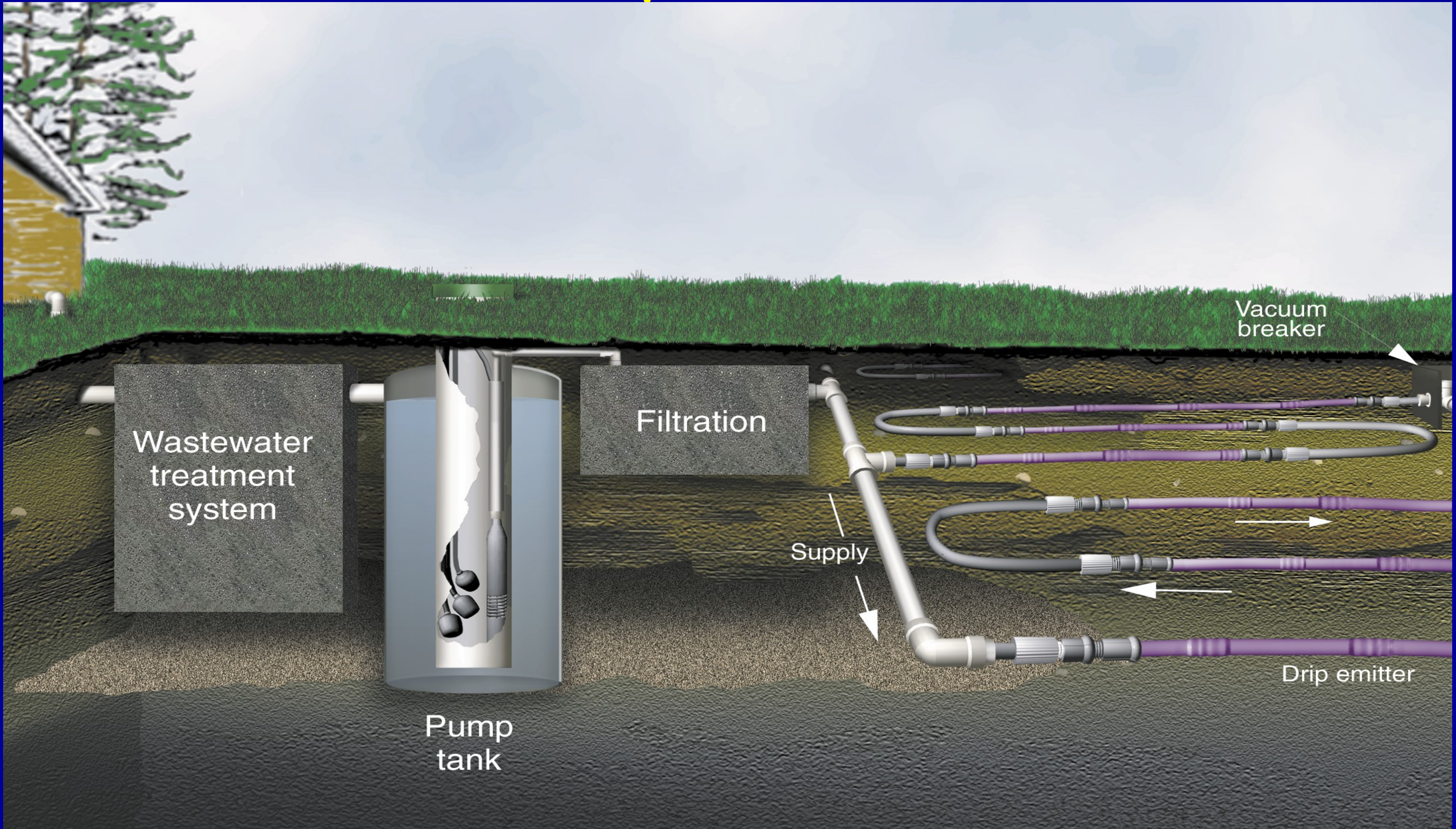
Low pressure distribution based on balanced flow of water.

Check for blocked emitters.

Flush lines.

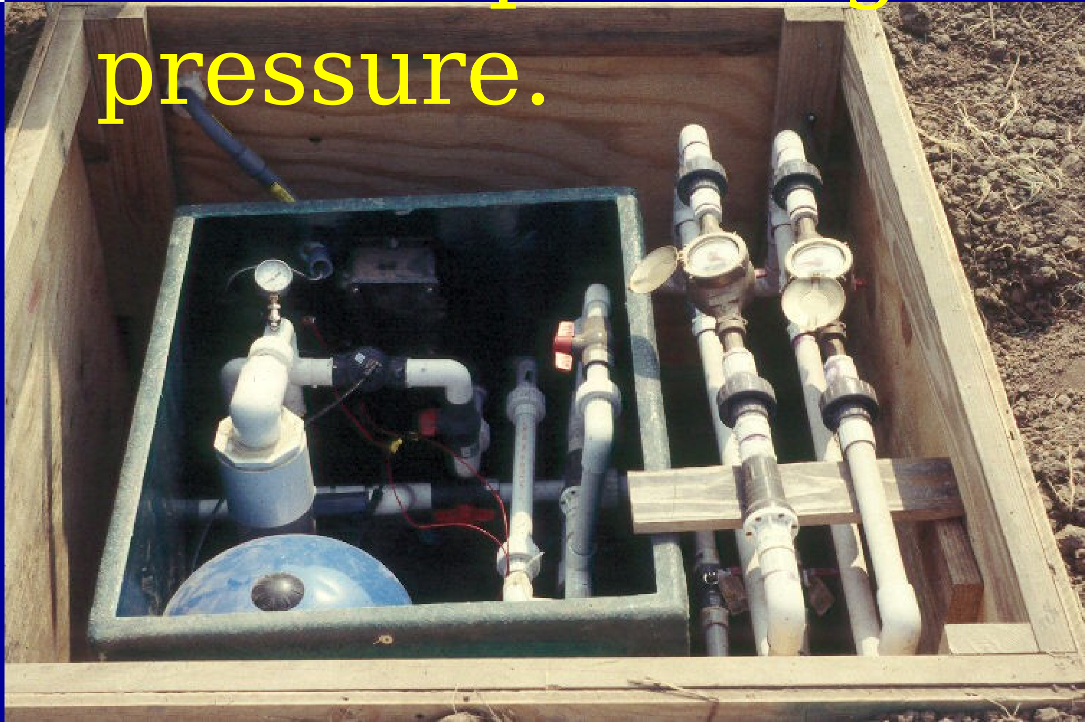
Low Pressure Distribution Drain Field

Sub-Surface Drip Dispersal System


Vacuum breaker
Filtration
Wastewater treatment system
Supply
Drip emitter
Pump tank

Check the control panel (pump run times, number of cycles, etc.)

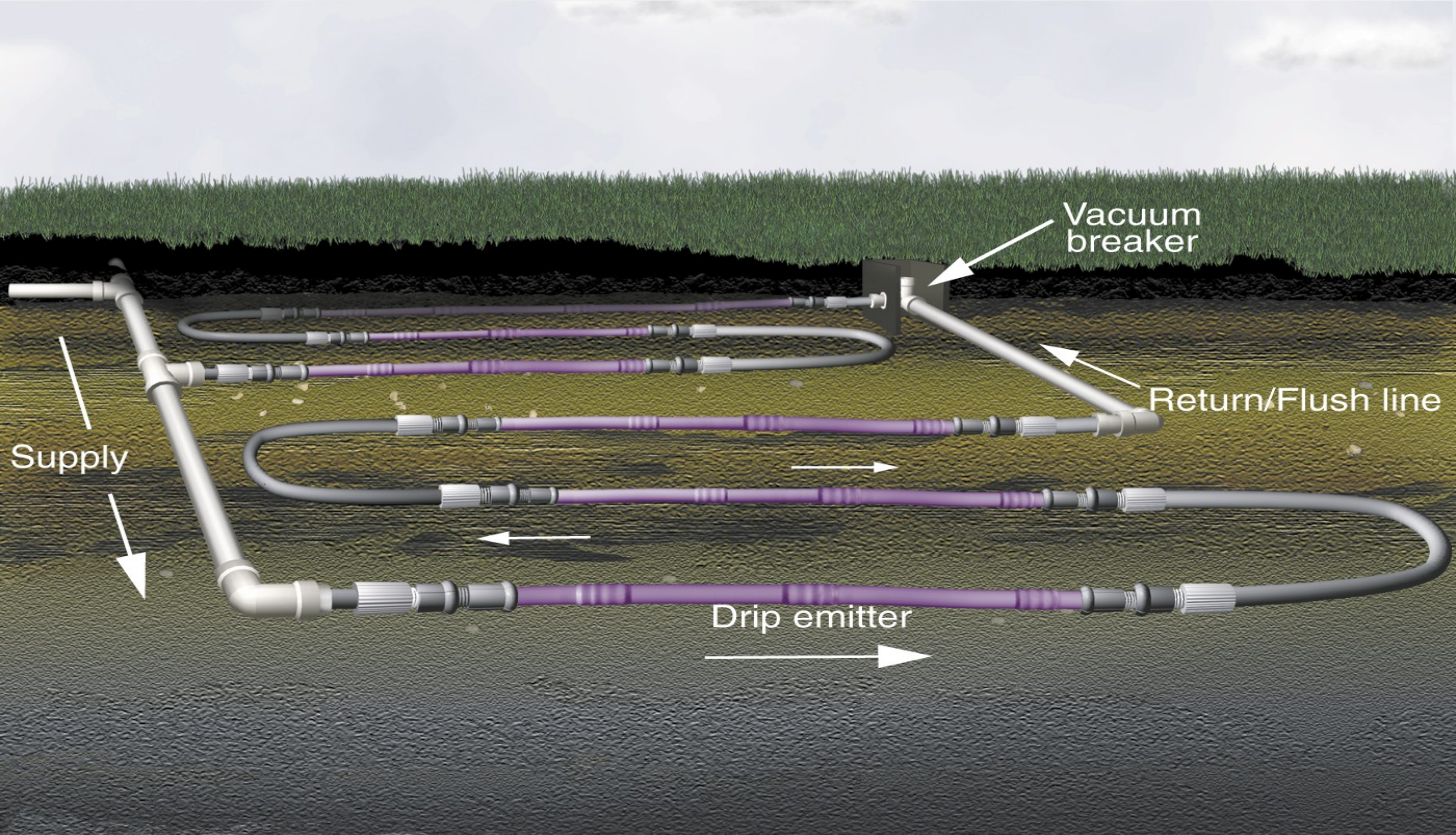
Check operating pressure.



Check filtering system (make sure automatic backwash is functional.

Check the filter

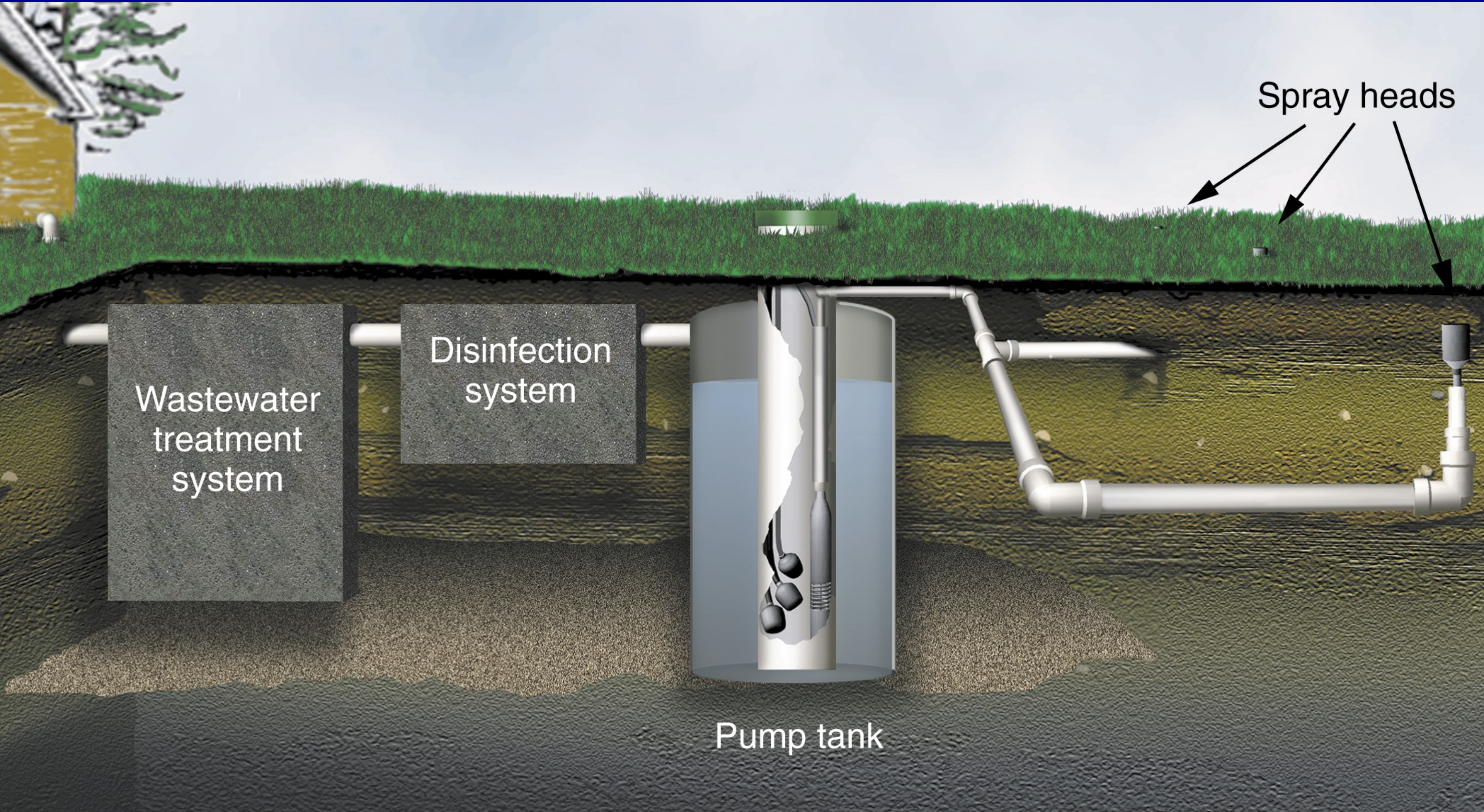
Subsurface Drip Dispersal Drain Field


Vacuum breaker
Return/Flush line
Supply
Drip emitter

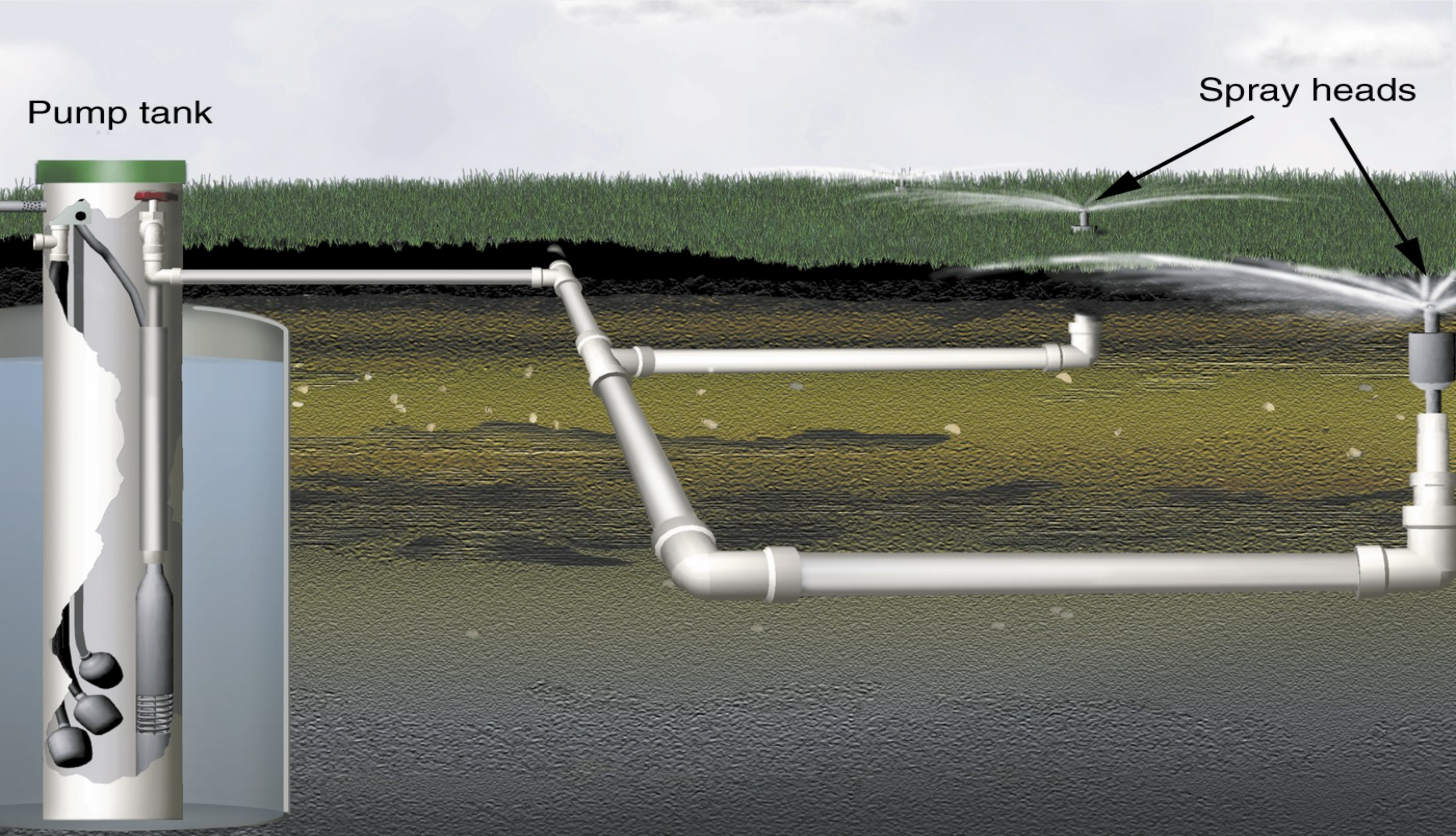
Subsurface Drip Tubing

Drip Dispersal Field at a School

Spray Dispersal System


Spray heads
Disinfection system
Wastewater treatment system
Pump tank

Spray Dispersal


Pump tank
Spray heads

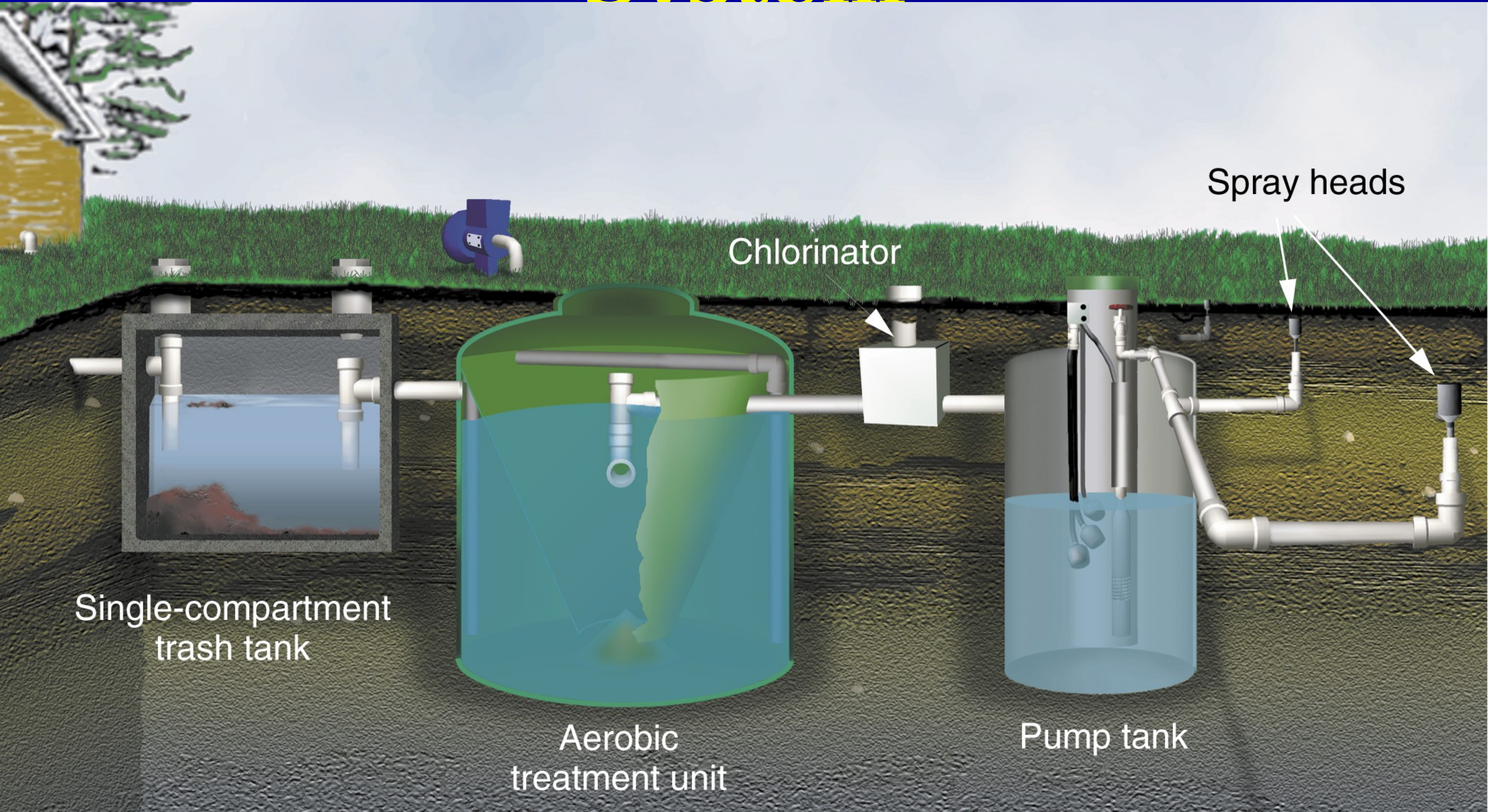
Wastewater spraying in a landscaped bed and yard.

Check operating pressure of the system.

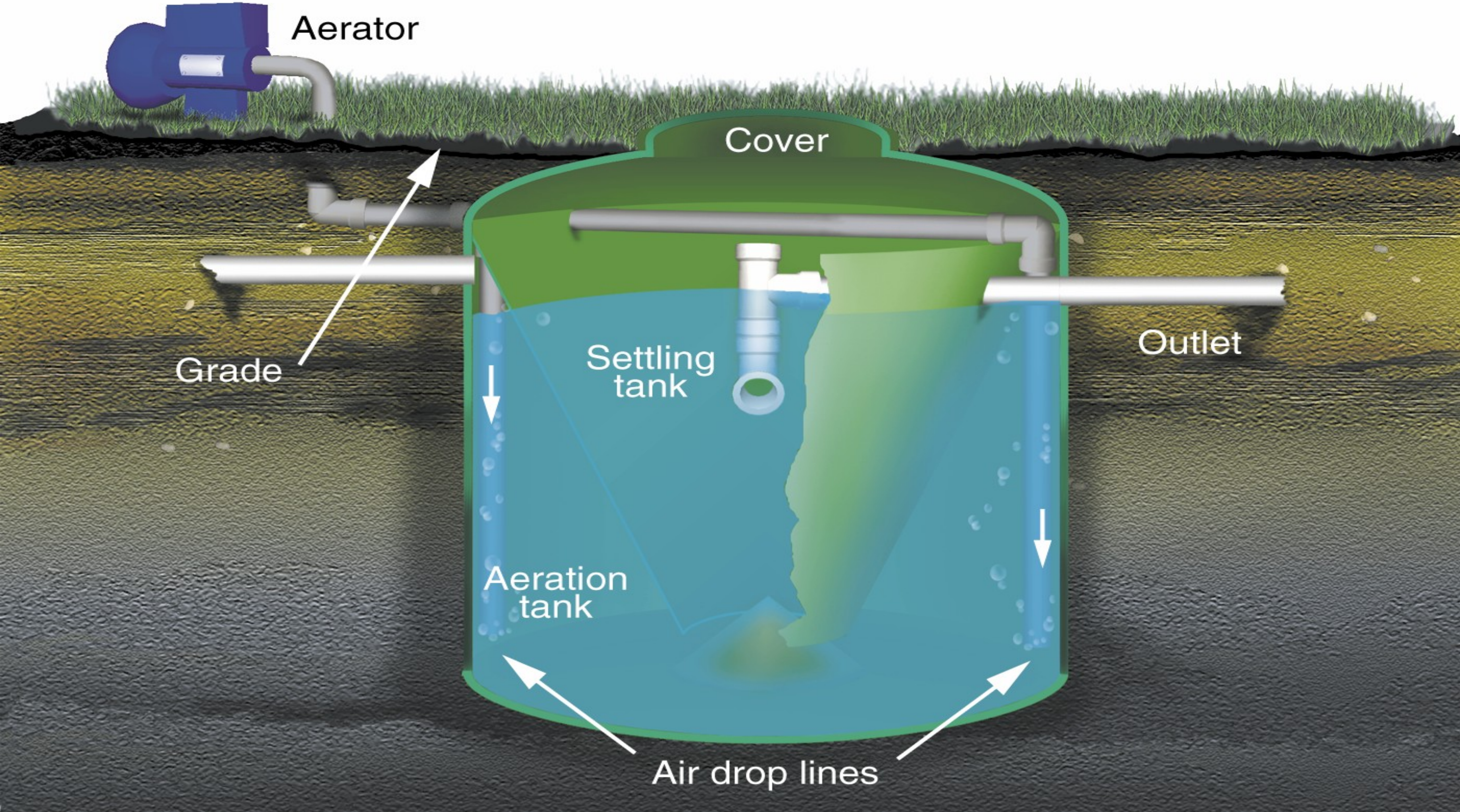
Check the spray heads to make sure they are not broken.

Check spray direction and

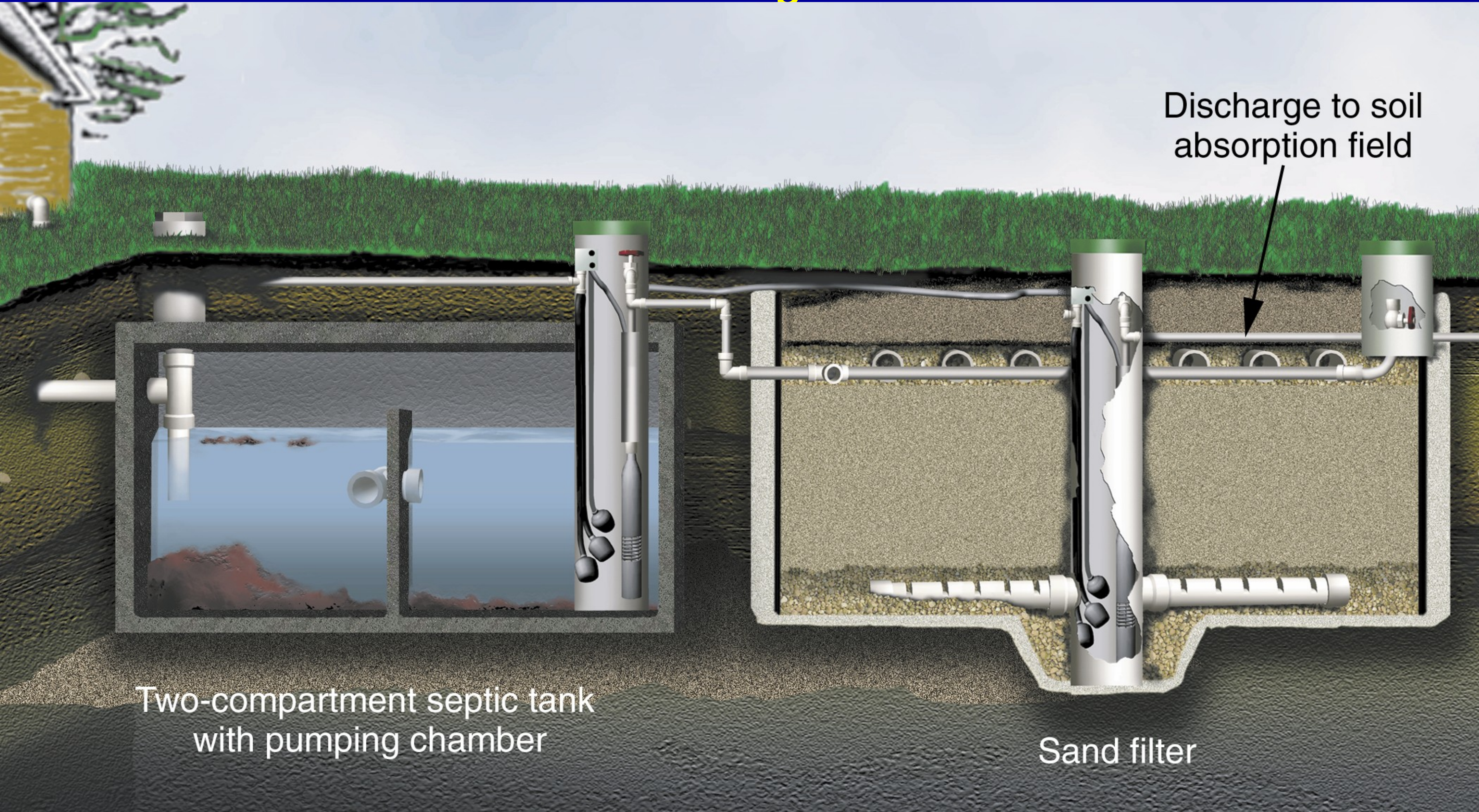
Aerobic Treatment Unit System


Spray heads
Chlorinator
Single-compartment trash tank
Aerobic treatment unit
Pump tank

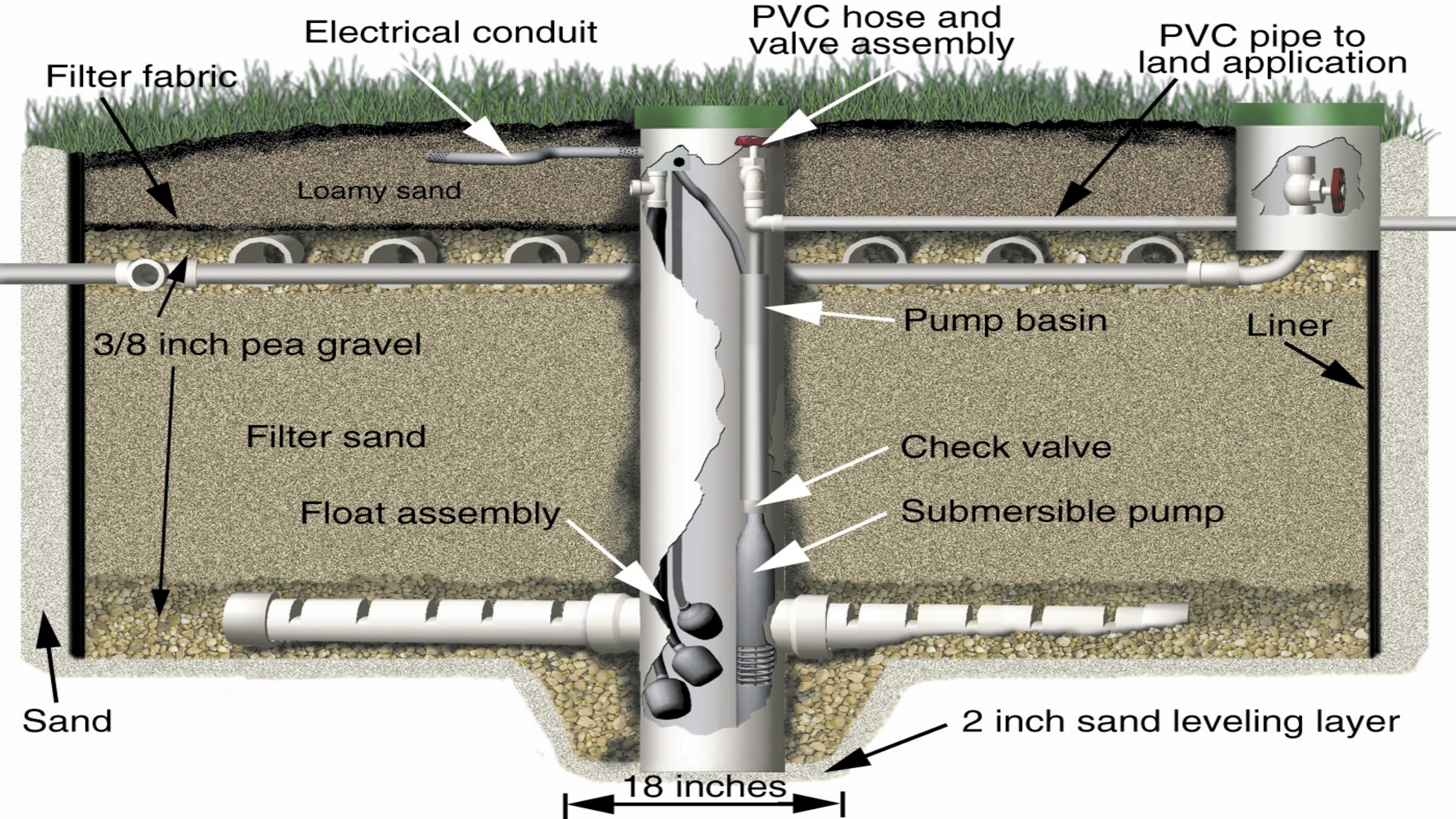
Aerobic Treatment Unit


Aerator
Cover
Grade
Settling tank
Outlet
Aeration tank
Air drop lines

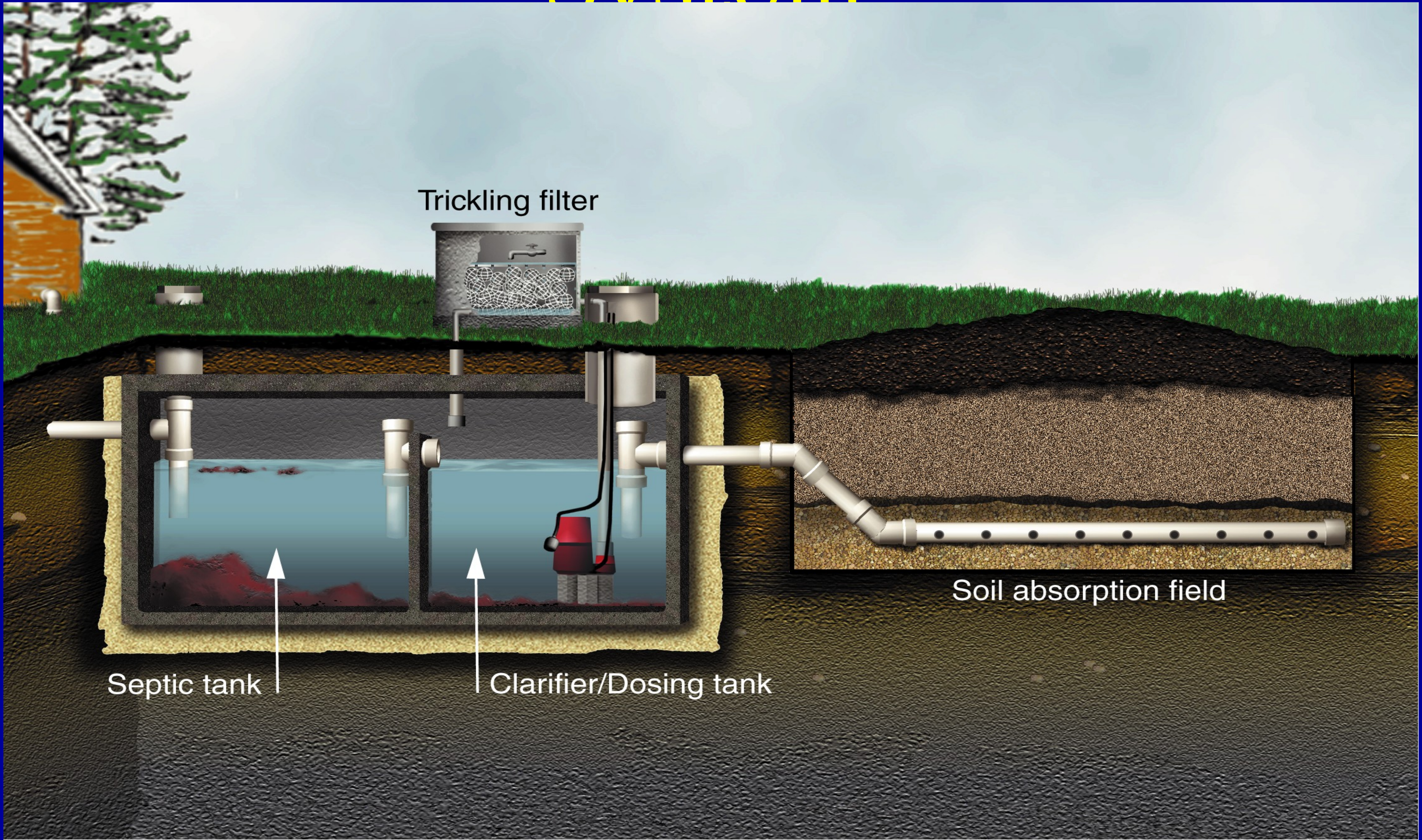
Buried Intermittent Sand Filter System


Discharge to soil absorption field
Two-compartment septic tank with pumping chamber
Sand filter

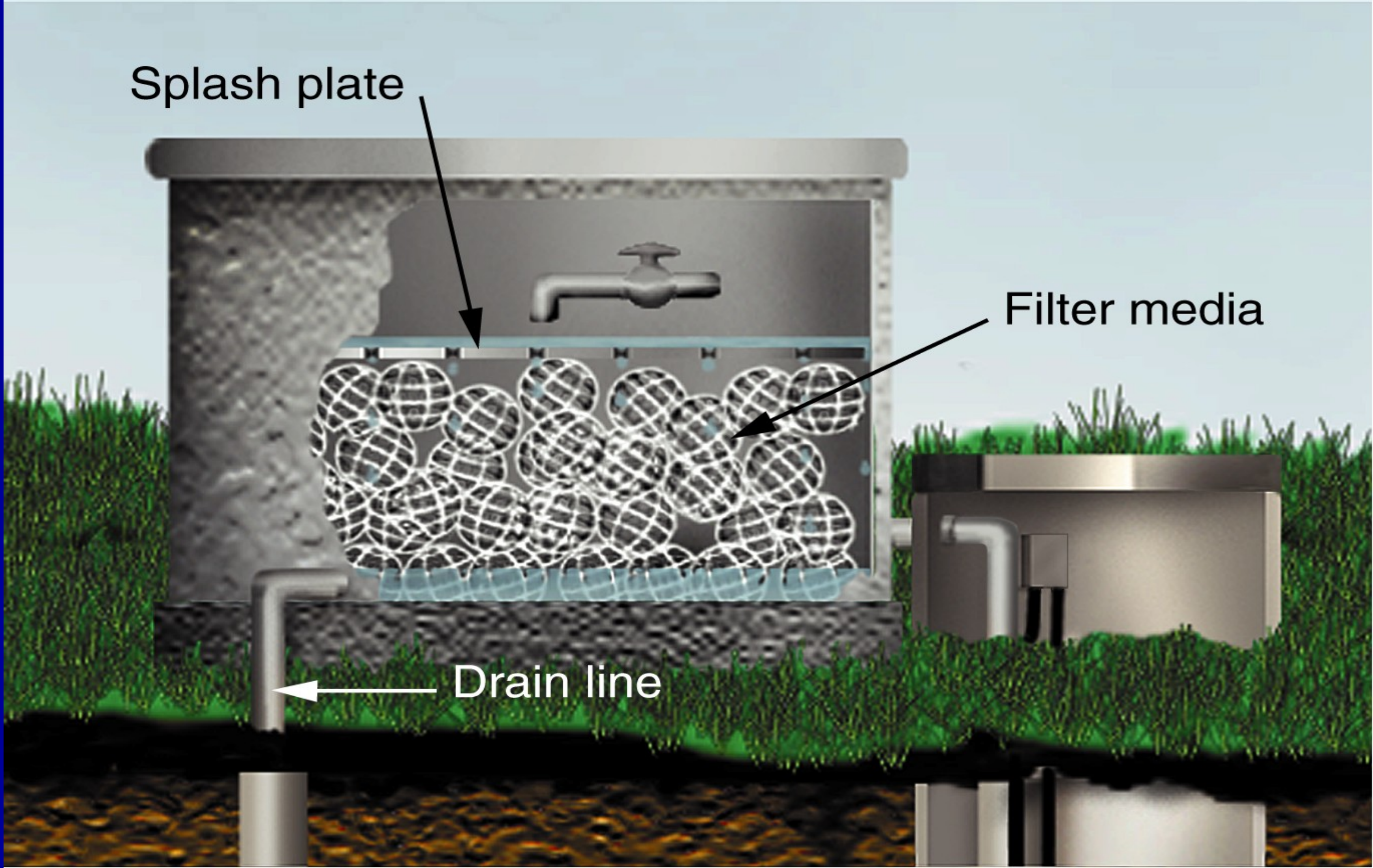
Buried Intermittent Sand Filter


Electrical conduit
PVC hose and valve assembly
PVC pipe to land application
Filter fabric
Loamy sand
Pump basin
Liner
3/8 inch pea gravel
Filter sand
Check valve
Float assembly
Submersible pump
Sand
2 inch sand leveling layer
18 inches

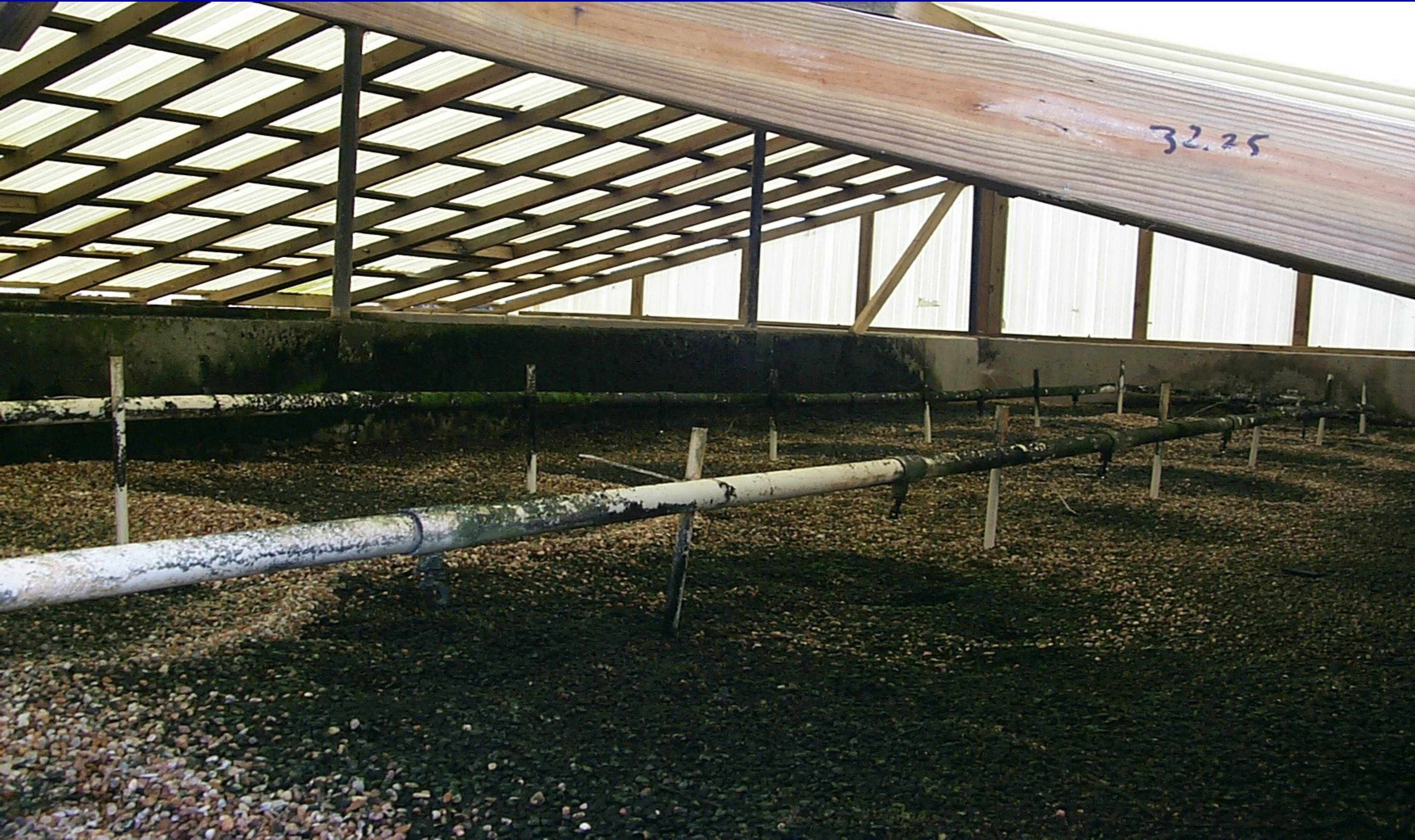
Recirculating Media Filter System

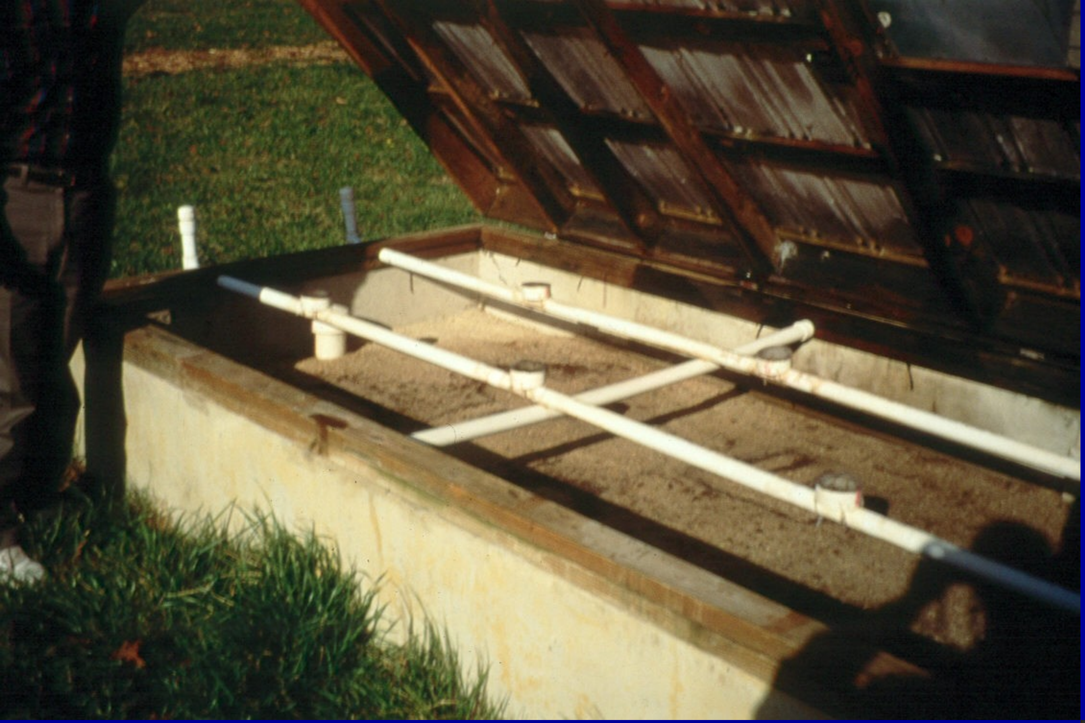

Trickling filter
Soil absorption field
Septic tank
Clarifier/Dosing tank

Recirculating Media Filter


Splash plate
Filter media
Drain line

Gravel Media Filter





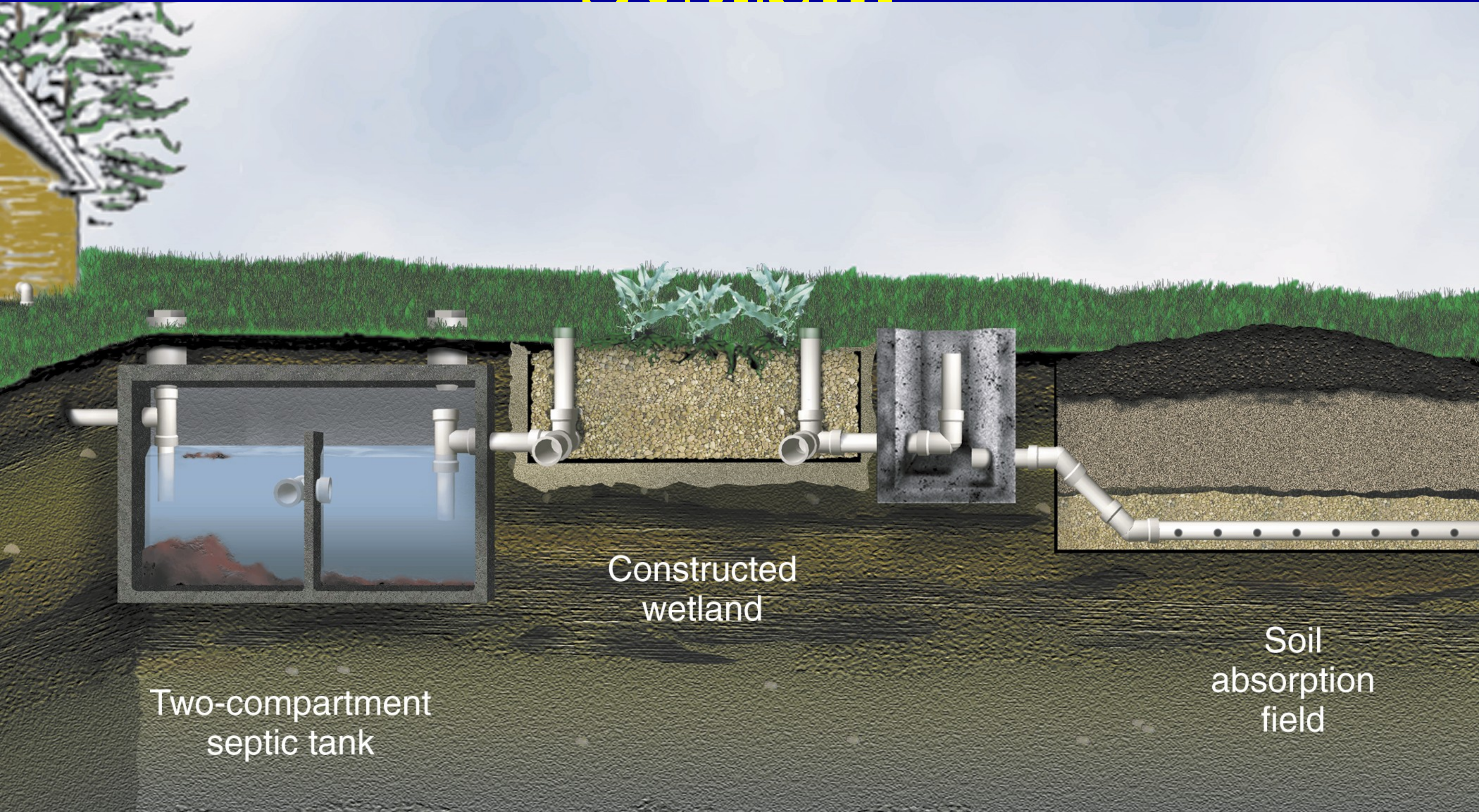
Sand filter needs uniform distribution of the water. Check loading rate on the media.

Check water infiltration into bed.

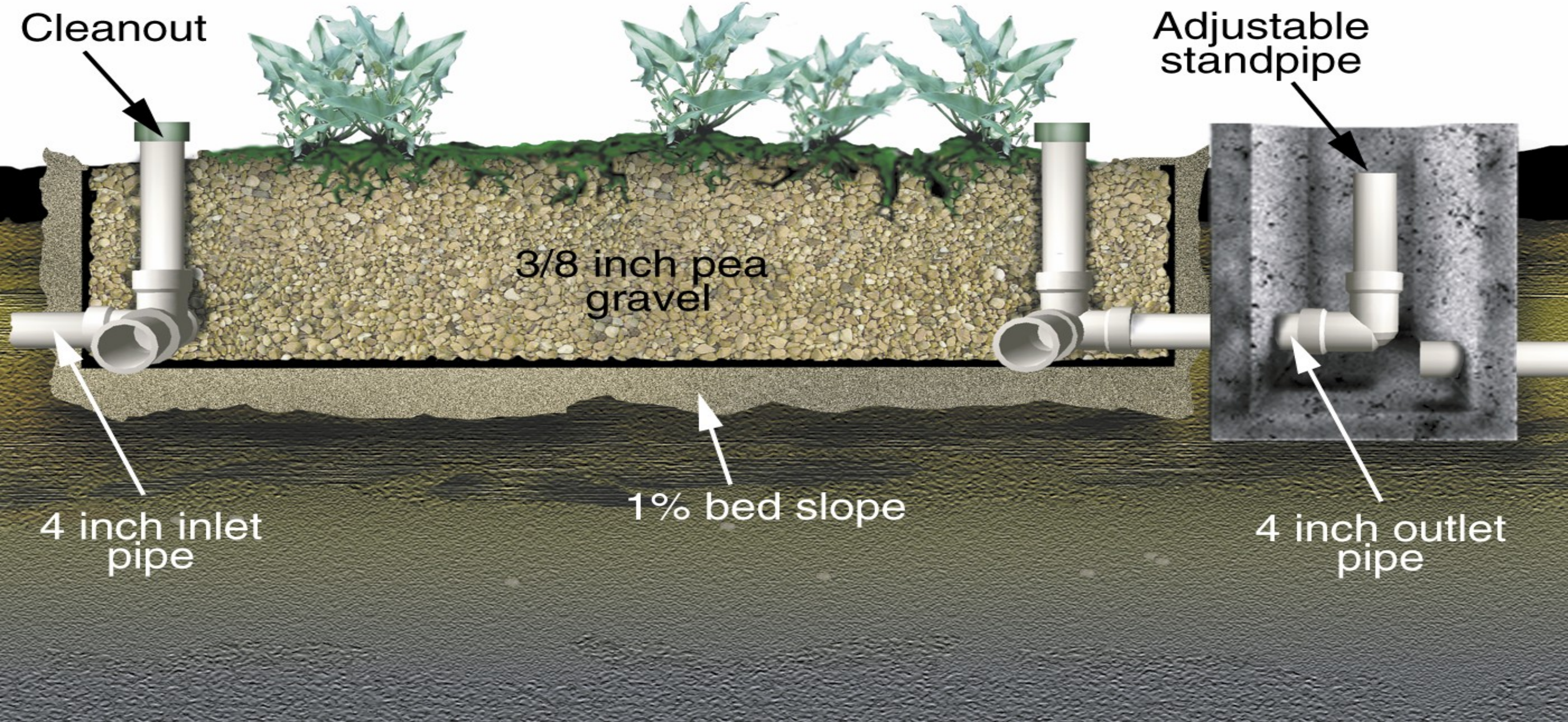
Disturb crust developing on the surface.

Replace top portion of

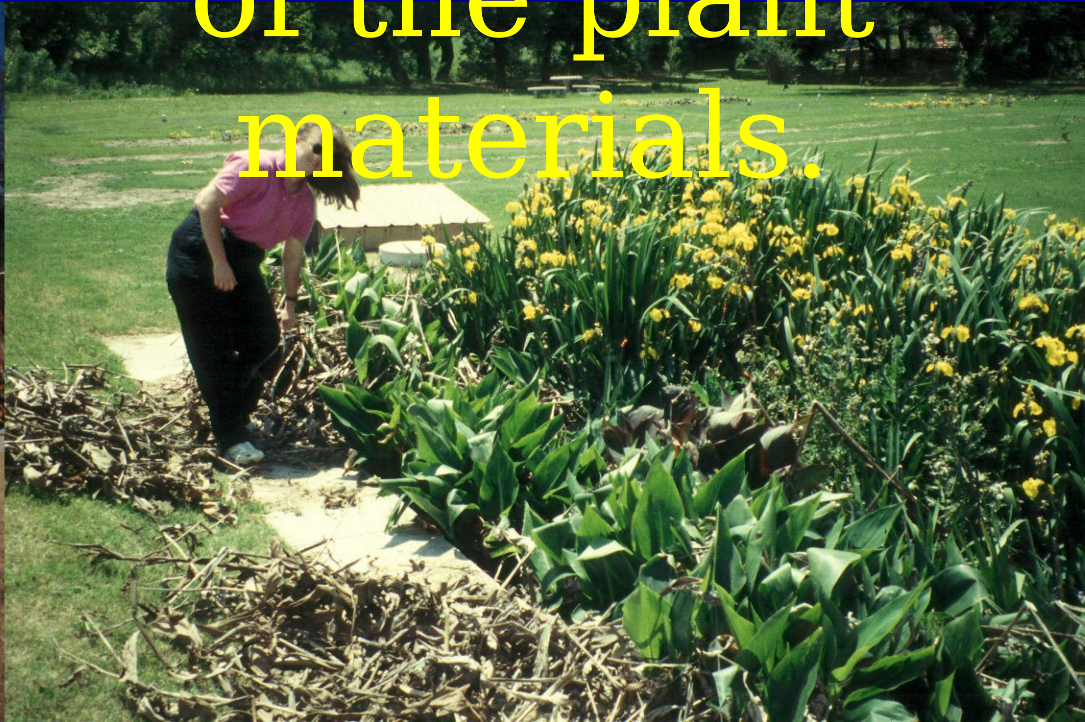
Constructed Wetland System


Two-compartment septic tank
Constructed wetland
Soil absorption field

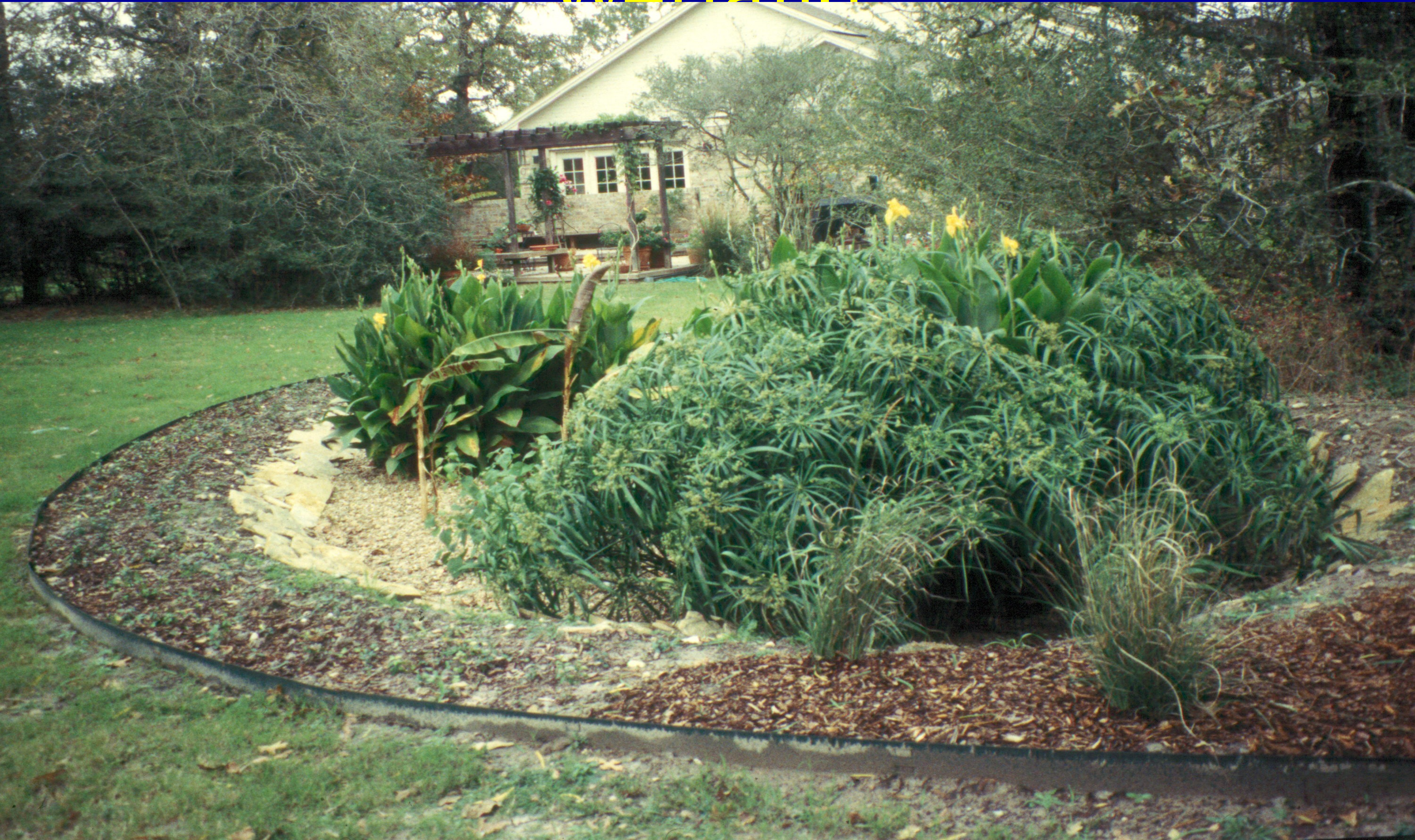
Constructed Wetland


Cleanout
Adjustable standpipe
3/8 inch pea gravel
4 inch inlet pipe
1% bed slope
4 inch outlet pipe

Wetland systems require management of the plant materials.



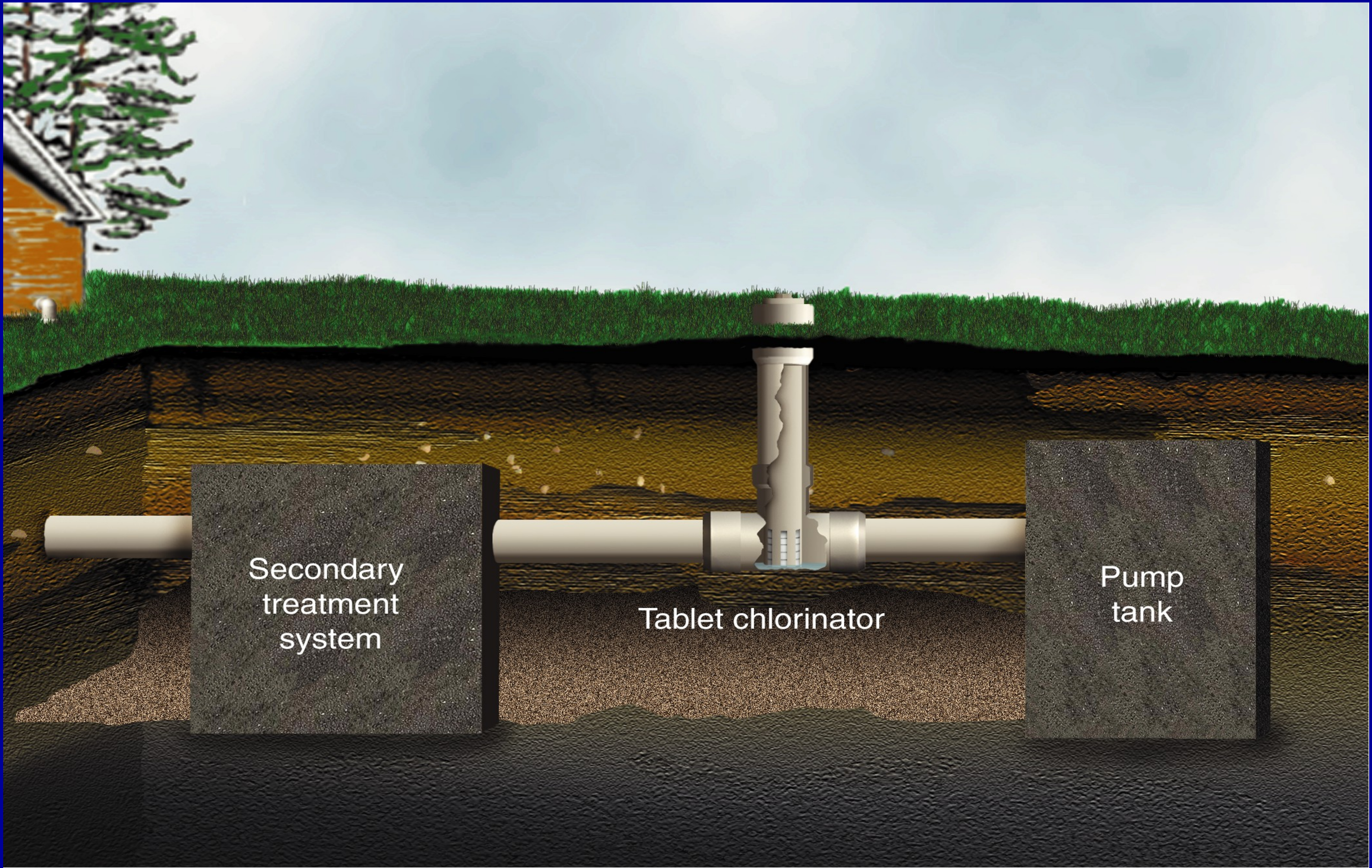
Residential Constructed Wetland



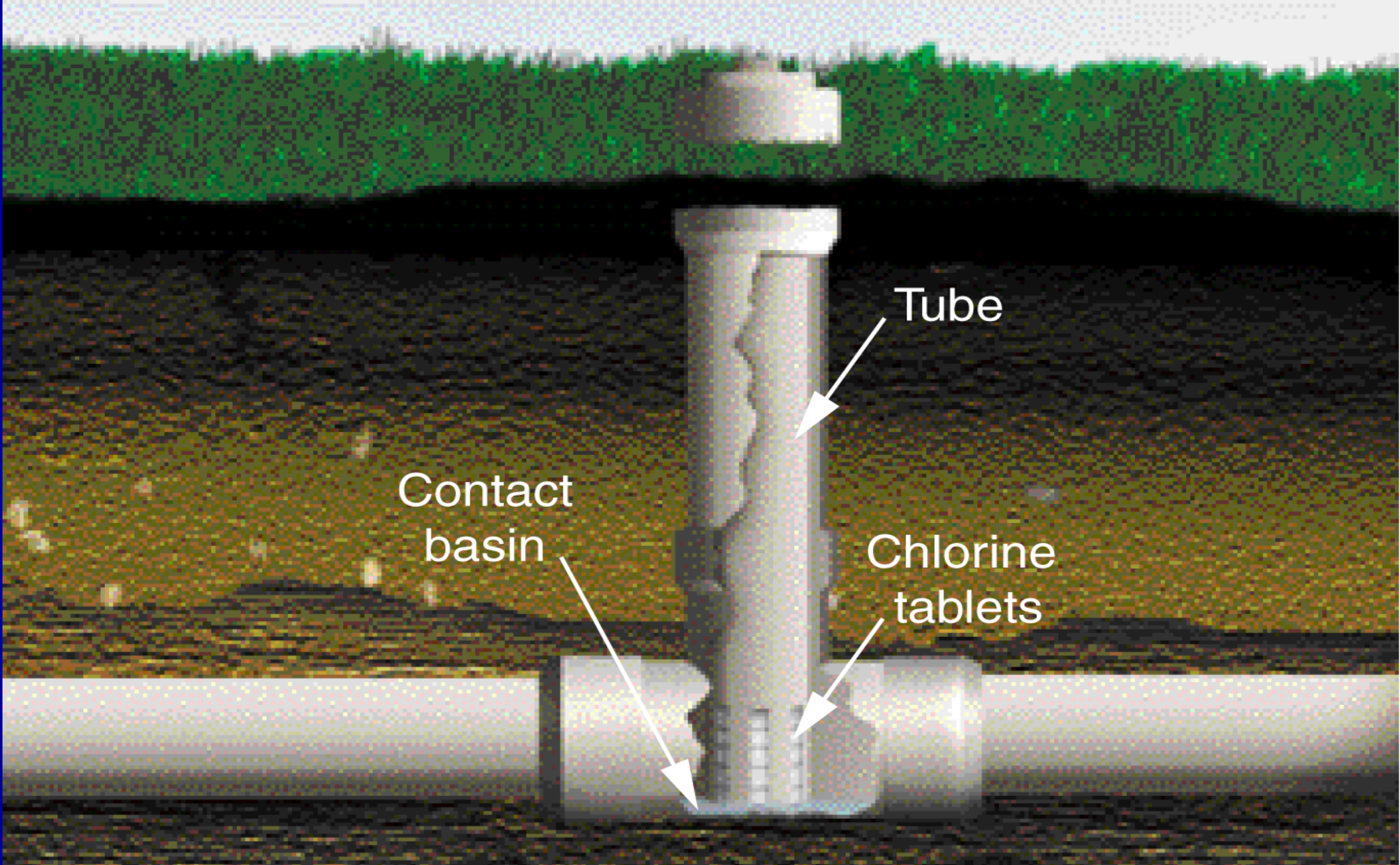
Disinfection

- Chlorination
  - Tablet
  - Liquid
  - Gas
- UV Light
- Ozonation

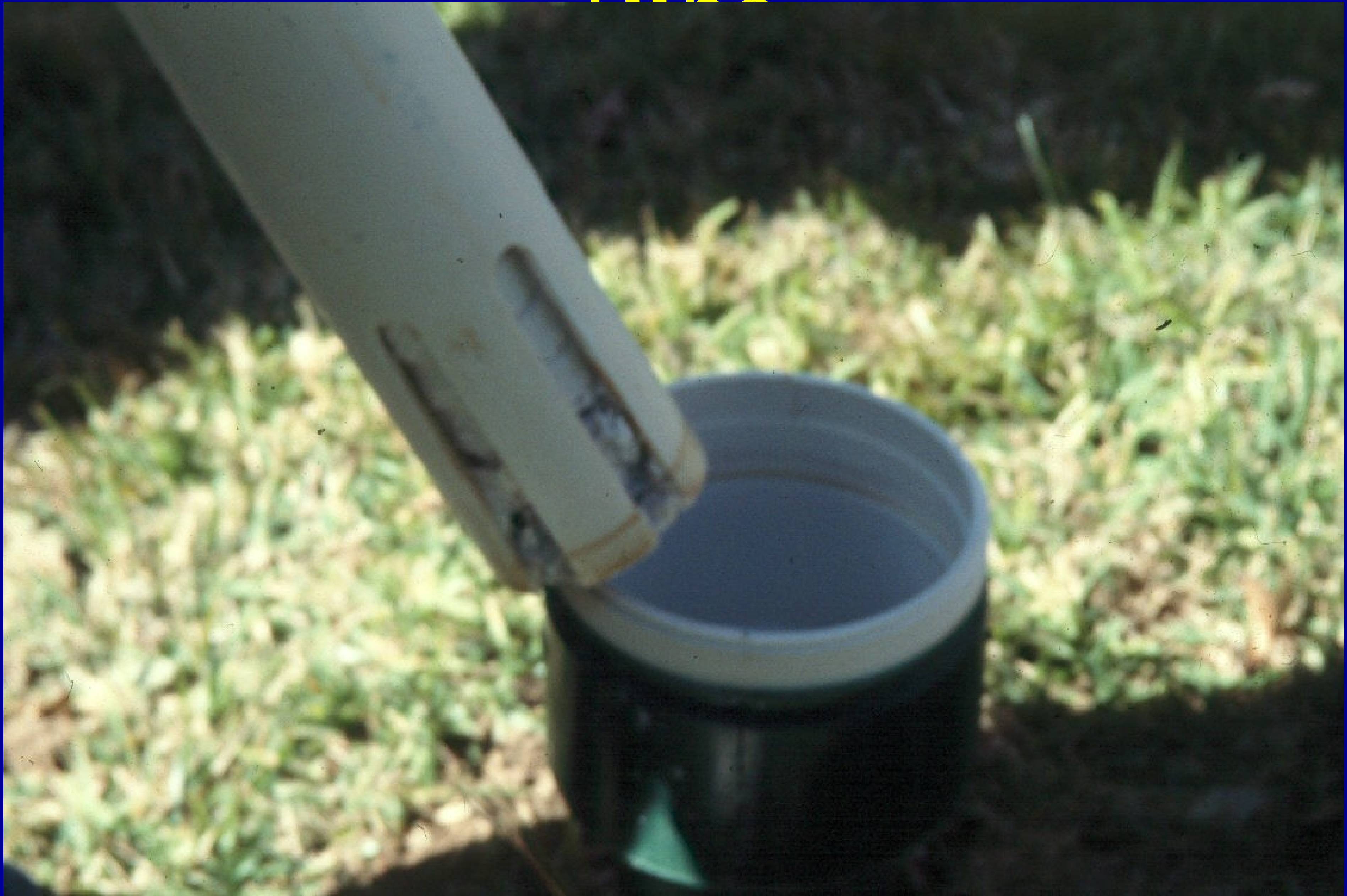
Tablet Chlorination System


Secondary treatment system
Tablet chlorinator
Pump tank

Tablet Chlorinator


Tube
Contact basin
Chlorine tablets

Chlorine Tablets in the Stack Tube



Water Quality Monitoring / Operation and Maintenance

- Monitoring system performance
- All systems require operation and maintenance
  - Frequency
  - Types of activities
  - Types of inputs

Summary

- A site evaluation is critical to determining the potential for a site to treat wastewater.
- Advanced pretreatment and final treatment and dispersal technologies are available for most situations.
- Select the most appropriate technology and scale of system for your site.
- Operation and maintenance is critical for long-term function